# PUBLIC WORKS

Feb. 1959

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Wylie W. Gillespie is a partner in the firm of Smith & Gillespie, Consulting Engineers of Jacksonville, Fla. More data on page 18.

# Them was the days...

Things just haven't been the same since they put in these *new*-fangled chlorinators. Joe . . . fellow that used to take care of the chlorinators . . . he was shifted to the pumps. Hardly ever get to see him at all anymore.

Then, where they used to have a whole slew of chlorinators, now they only have half as many. Something about "reliability"

Well, I don't know about this reliability stuff. Don't have too good a grasp of maintenance either. But it sure does get lonely around here nowadays. Even the *smell* is gone!*

Personally, I happen to like the old-fashioned way of doing things. But it seems like everybody turned against me the day Fischer & Porter started making chlorinators.

*If you like the old-fashioned way, all well and good. But if you don't, perhaps you'd better get the facts on new-fashioned chlorinators from Fischer & Porter Company, 529 Fischer Road, Hatboro, Pennsylvania.*

**FP FISCHER & PORTER CO.**

*Instrumentation and Chlorination*

*Any wonder everyone's *trying* to copy F&P's design now?

Accelerated

# CRP*

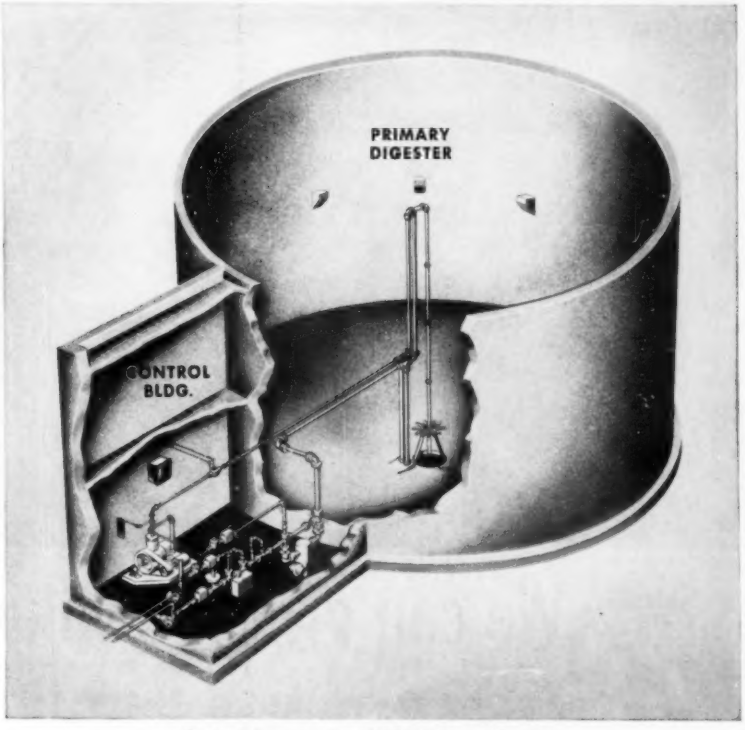
Sludge Digestion System

*A Trademark of CHICAGO PUMP COMPANY

"from Chicago"

# Unparalleled Savings... Provided by Correct Biological Environment for Accelerated Digestion

*U.S. Patent Nos. 2,777,815 and 2,786,025 . . . Foreign Patents . . . others pending*




Typical layout of a CRP* Primary Digester

## These Are Typical Savings:

**Columbus, Ohio**

1 primary tank converted to CRP* digests the amount of sludge solids handled by 3.5 conventional digesters.

**Moorhead, Minnesota**

Conversion of old primary tank to CRP* provided operation savings of more than $8,000 annually over previous system.

**Lake Charles, Louisiana**

Conversion of one existing 45′ primary tank to CRP* eliminated need for new 70′ tank.

**Seattle, Washington**

***Southwest Suburban Sanitary District***

Construction of one 27′ square primary tank with CRP* serves population of 40,000.

***there are 21 CRP* systems in successful operation . . . 10 more on order.***

The CRP* Gas Treating System . . . a development of 12 years of continuous research, pilot plant and full municipal scale operation . . . provides correct biological environment for accelerated digestion. 21 successful operating installations attest to the proper application of gas recirculation practiced by this system.

Consulting Engineers are invited to request specific data direct from Chicago Pump Company, Department A, or by contacting Distributors located in most principal cities . . . concerning the application of CRP* systems to plants under design or plants requiring expansion.

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*Putting Ideas to Work*

FOOD MACHINERY AND CHEMICAL CORPORATION

**Chicago Pump Company**

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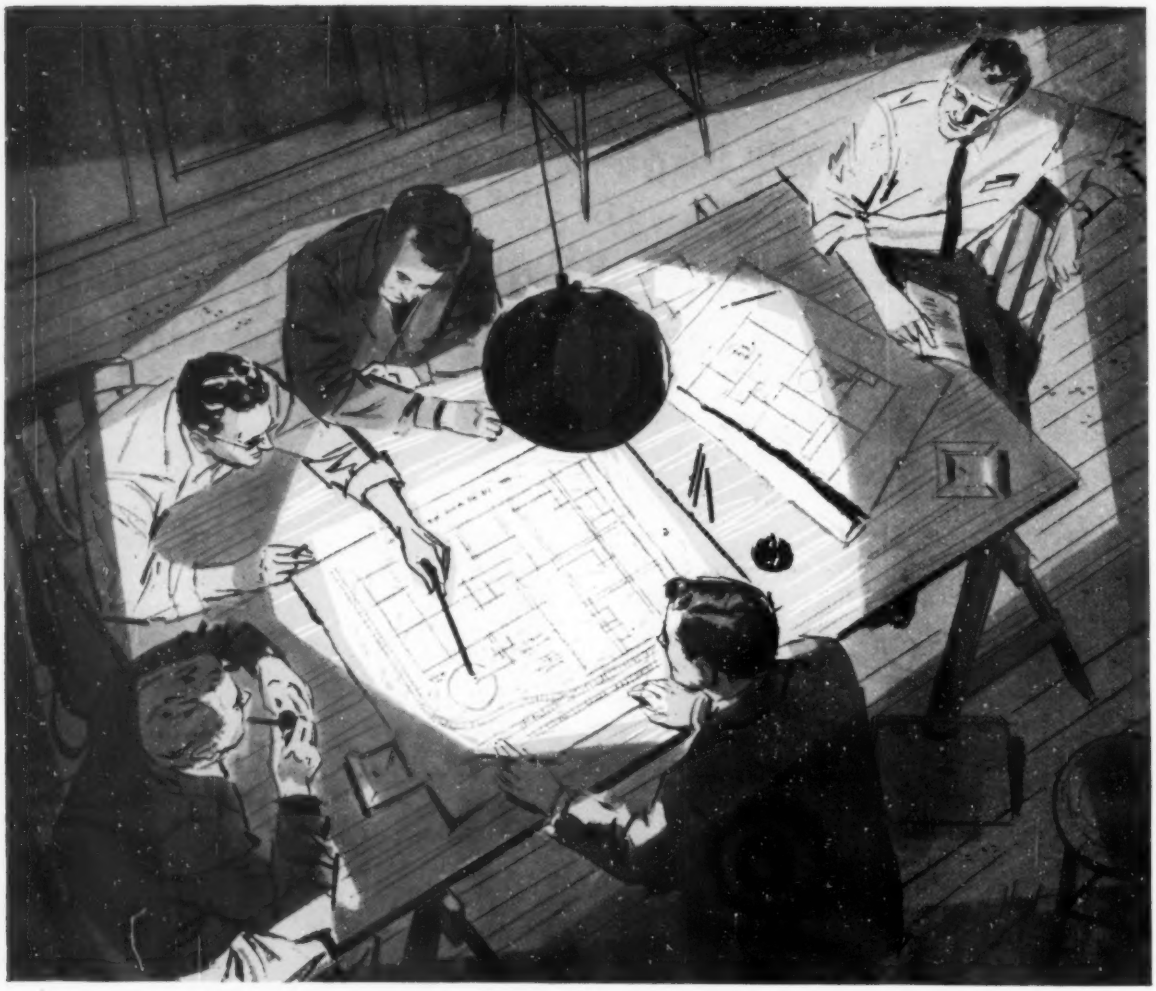

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The Morton Consulting Engineers have experience with all types of water softening systems for all types of uses. The assistance they offer is well worth an inquiry. If you think a Morton Consulting Engineer could be of assistance to you, just send in the coupon today.

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**THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES**

# Cleans up to 120 feet of sludge bed per hour

## Mechanical cleaner provides faster and more efficient sludge removal than conventional hand cleaning methods

Here's a mechanized method of cleaning sludge beds that will pay for itself in a relatively short time. While individual savings depend on such variables as size of plant, available manpower, method of disposal, etc., annual savings of 60% have been reported over conventional hand cleaning.

The sludge bed cleaner offered by Link-Belt is essentially a conveyor system on wheels . . . the system is mounted on a standard tractor, which travels on concrete runways in sand beds and cleans a path up to 26 feet in width. Performance-proven Link-Belt conveying and power transmission components are combined into an efficient mechanism that is operated by hydraulic motors.

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For more detailed information on how you can clean sludge beds faster, more efficiently, call your nearest Link-Belt office. Send for Folder No. 2671.

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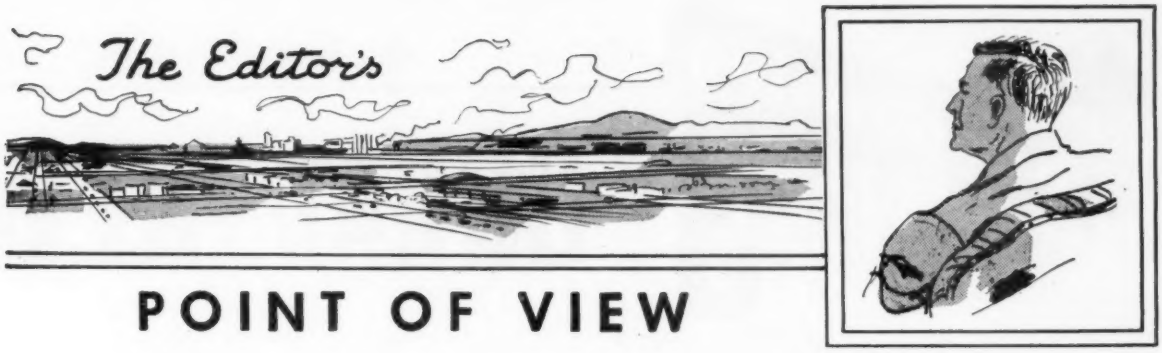
LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World. 14.902




### The Interstate Highway System and Future Planning

IN CONSIDERING the Interstate Highway System it is usual to think of it in terms of its influence on highway travel and transportation facilities. This is a narrow view for the construction of these highways will affect many phases of our economy. There will be business, industrial and residential development along the routes, creating new problems in water supply, sewerage, refuse and paving. Since in many cases the highways will follow valleys building in flood plain areas will be encouraged resulting in a growing demand and a greater need for flood control and protection works.

It is not easy to visualize in advance the powerful effect that a modern highway system can have; but we can rest assured that many and far-reaching problems will arise for which plans should be made in advance. Each problem will be largely a local one in that its solution will depend upon many local conditions, though basic principles will not change. State planning should work with local planners; and counties, which have been notoriously slow in this important field, must also join in the program if they are to avert the development of many acute problems in the future.

### Consulting Engineers Fill an Important Place in Public Works

TWO ESSENTIAL factors in public works engineering are supplied by consulting engineers—specialized knowledge and skill and a ready-to-go organization. We believe that every county, city and state—and the Federal government as well—should have adequate engineering staffs; but these need not and generally should not be maintained at a level capable of handling the unusual job. The large sewage treatment plant, water supply project, bridge or highway is better handled by the consultant; and often this applies also to our modern divided highways.

There is no question of the ability of governmental engineers to do the work; the problem is one of quick enlargement of the staff for the oversized job, the creation of team work and team spirit and the development and application of administrative methods. These take time and cost money; the capable consulting engineering organization carries these items as regular stock in trade. Together, the governmental engineer and the consultant can do work better and at lower cost; each supplies an important share of knowledge and ability; and each should be used in the field in which it can render best service.

### The First Step in Solving the Water Supply Problem

ADEQUATE TREATMENT of the waste waters used for municipal and industrial purposes is the first and most important job in any overall program to increase our water resources. There has been much misconception in respect to water supply and water use. Of the some 1200 billion gallons per day available from runoff, less than 10 percent is consumed (largely by irrigation). Of the 17 billion used for public supplies and the 111 billion used by industry, about 97 percent is returned to stream flow. Not only is this water polluted but, unless properly treated, it largely spoils for further immediate use the streams into which it is discharged.

Treating these domestic and industrial wastes so they can be reused will not automatically remedy all our water quantity problems, but will help more than any other single thing that can be done, so far as present knowledge is concerned. Desalting sea water may help some cities; reaching out for new sources will help others; some areas will never have an adequate supply. But a full use of present knowledge in waste water treatment can mitigate all three problems.

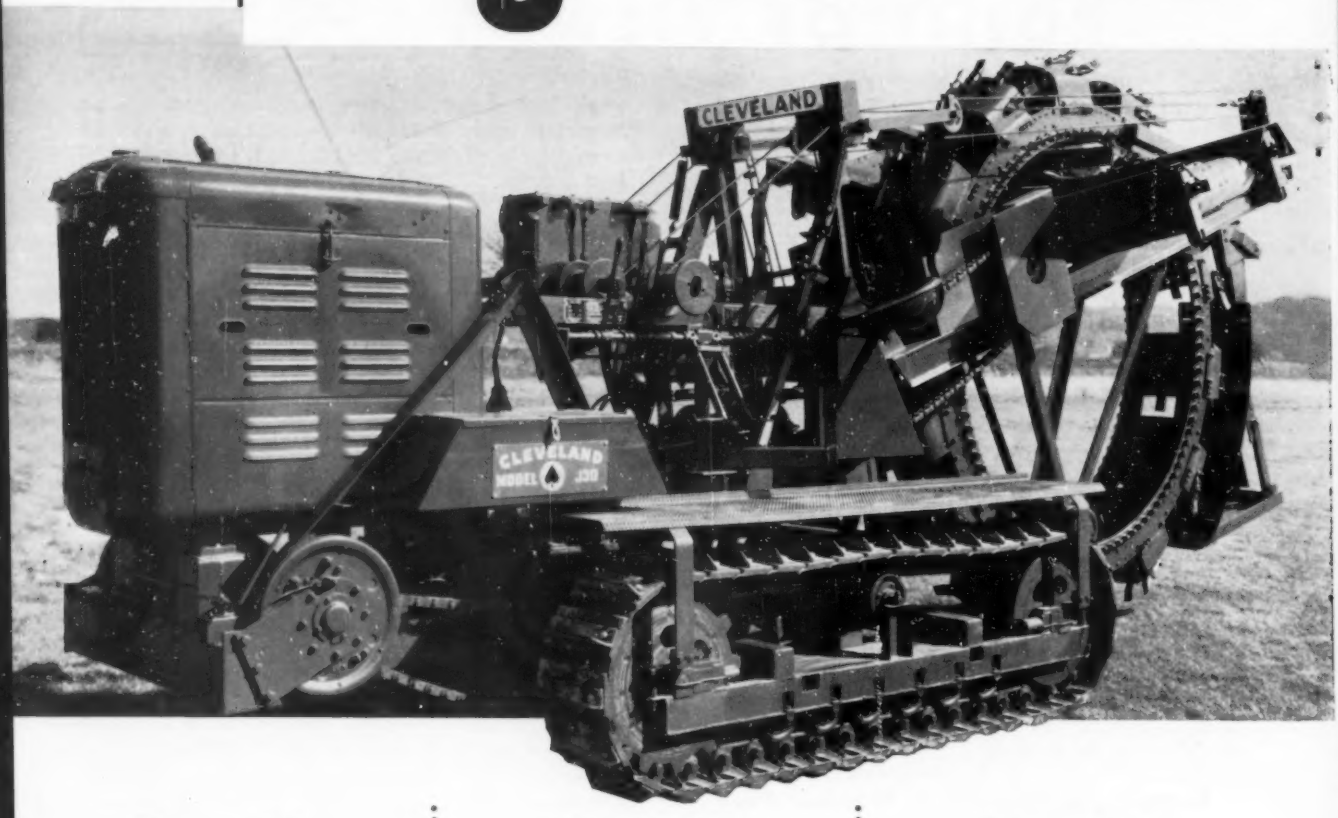
### Needs for Municipal Sewage Treatment

ALMOST 4,000 new municipal sewage treatment plants to serve 22.2 million people are needed now to replace existing treatment plants and for systems presently discharging raw sewage, according to a very recent study by the Public Health Service. In addition to the requirements for new plants, 779 plants serving 17.0 million people require enlargement and 851 plants serving 8.4 million people need the addition of new units or processes.

These data do not represent all that is needed for the satisfactory control of pollution for they do not take account of industrial wastes. However, they contribute valuable information on our present status and on the vast amount of waste handling construction that needs to be done. The study is a fine one and the authors and the Public Health Service are to be congratulated.

Announcing

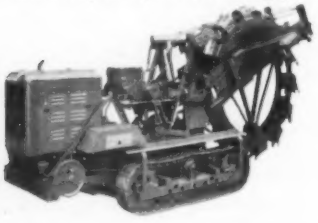
# 3 GREAT NEW




## The J-20

Width over crawlers ..... 4′ 10″
Crawler length, C.C. ..... 6′ 3″
Overall length ..... 21′ 6″
Width of crawler shoe ..... 10″
Weight ..... approx. 13,500 lbs.
Ground bearing pressure ..... 8.8 psi.
Cuts trench 13″ to 24″ wide, to 5′ 6″ deep

Principal applications:
urban areas, utilities lines, services, extensions, mains, house footings, etc.



## The J-30

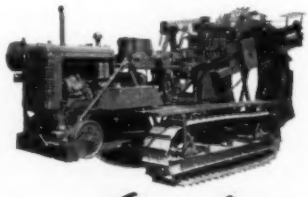
Width over crawlers ..... 6′
Crawler length, C.C. ..... 6′ 9″
Overall length ..... 22′
Width of crawler shoe ..... 14″
Weight ..... approx. 15,000 lbs.
Ground bearing pressure ..... 6.5 psi.
Cuts trench 13″ to 24″ wide, to 5′ 6″ deep

Principal applications:
suburban areas, drainage, utilities, gathering lines, footings, septic tanks, leach beds.

## The J-40

Width over crawlers ..... 8′
Crawler length, C.C. ..... 7′ 6″
Overall length ..... 23′
Width of crawler shoe ..... 18″
Weight ..... approx. 18,800 lbs.
Ground bearing pressure ..... 5.6 psi.
Cuts trench 17½″ to 30″ wide, to 5′ 6″ deep

Principal applications: trench up to 30″ wide —pipelines, waterlines, drainage, irrigation, sewer lines, utilities.



**...with the basic Cleveland characteristic...** *Quality*

# CLEVELAND TRENCHERS

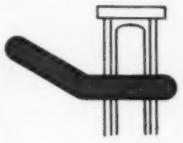
## *with* ...revolutionary new V conveyor

## ...world's finest trencher crawlers

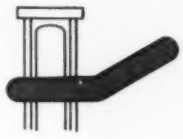
## ...all operations controlled at operator's seat

**V CONVEYOR** ... provides maximum clearance under digging wheel rims ...allows higher heaped loads without clogging ... provides constant elevating angle for faster, higher spoil discharge ... reduces rolling and tumbling ... has stronger torsion-free construction ... employs huskier, longer-lived bearings.

**AUTOMATIC CONVEYOR SHIFT** ... operator controls hydraulic shifting and positioning of conveyor ... digs past poles, trees, shrubs ... places spoil where needed ... *all* without leaving seat, without interrupting other operations.



**DUAL INDEPENDENT CONVEYOR DRIVE** ... identical, self-contained hydraulic motor and planetary gear drives in each head-pulley eliminate *all* conveyor chains and sprockets ... reduce belt slippage and wear ... furnish operator fingertip control of conveyor belt direction and speed (215-1,000 fpm) independent of all other operations.



**FINEST CRAWLERS ON ANY TRENCHER** ... employ double flanged wheels, rollers and sprockets with wide-spaced teeth ... drives on each end of 1½" dia. hardened pins ... completely eliminates pockets for dirt, stones, etc. ... eliminates take-up devices ... gives greater track stability ... lengthens wear life ... sprockets, wheels and idlers ride on sealed ball or roller bearings requiring only 200-hour lubrication ... a tremendously long-lived, trouble-free, easy-rolling crawler track.

**BIG 16"x3" HYDRAULIC STEERING BRAKES** ... controlled by suspended-type foot-pedals ... provide simple easy steering and maneuvering.

**HYDRAULIC CRUMBING SHOE** ... now, crumbing shoe advantages (cleaning, grading) are practical even in crowded digging ... Cleveland's hydraulic shoe control (optional, extra) pivots shoe back and up to allow setting wheel to required depth at walks, drives, underground obstructions, etc.

Engine, Hoist, Wheel, Shoe, Conveyor Speed—Direction—Shift, Crawlers

**...Every Operation Controlled at Operator's Seat.**

*Good* *Everywhere*

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***Pioneers of the Modern Trencher***

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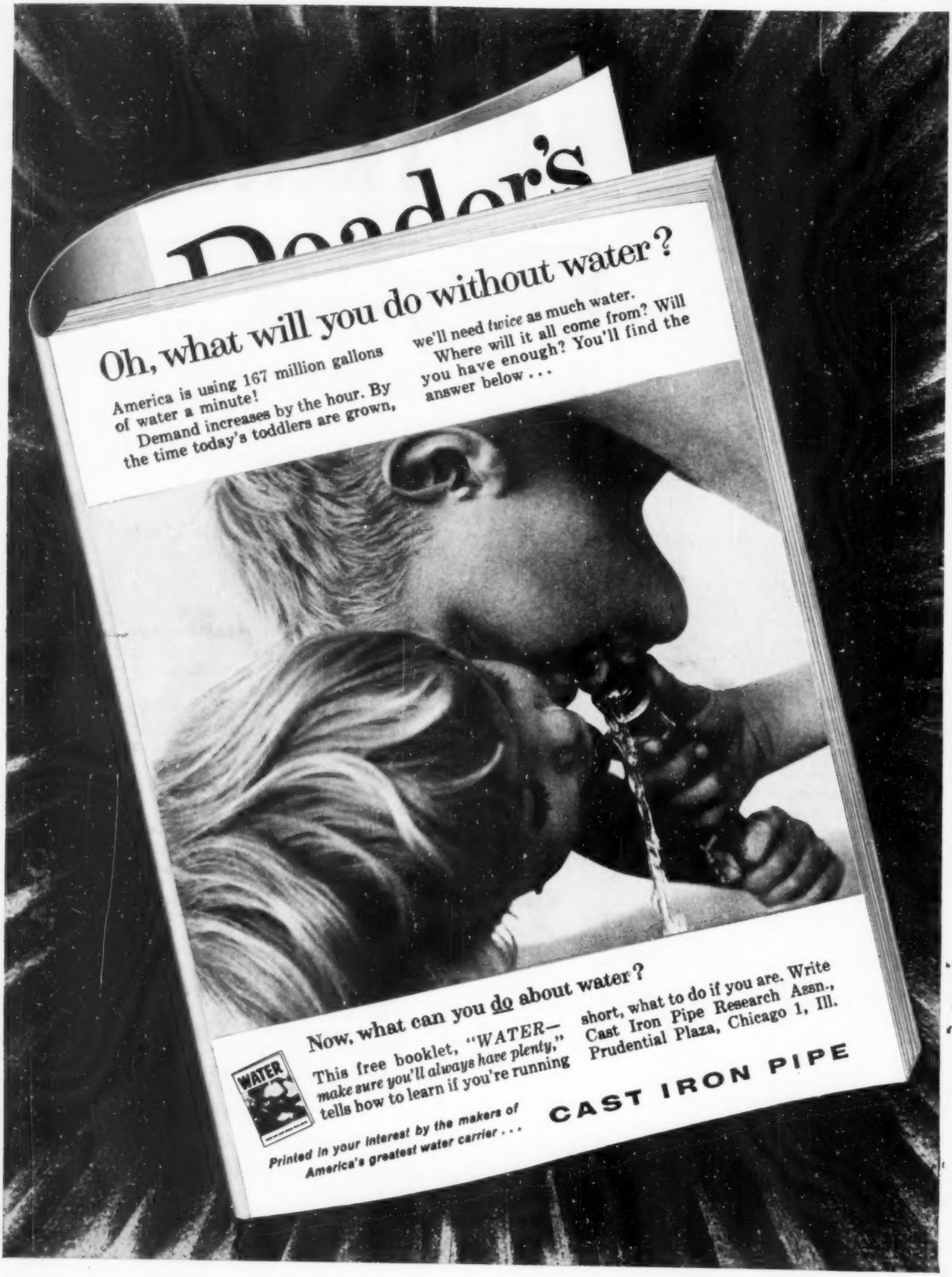

Reader's
Oh, what will you do without water?
America is using 167 million gallons of water a minute!
Demand increases by the hour. By the time today's toddlers are grown, we'll need *twice* as much water.
Where will it all come from? Will you have enough? You'll find the answer below . . .
Now, what can you do about water?
This free booklet, "WATER—make sure you'll always have plenty," tells how to learn if you're running short, what to do if you are. Write Cast Iron Pipe Research Assn., Prudential Plaza, Chicago 1, Ill.
WATER
Printed in your interest by the makers of America's greatest water carrier . . .
CAST IRON PIPE

# New Ad Campaign in Reader's Digest Dramatizes America's Water Problem

*Cast Iron Pipe Research Association promotes better understanding of water supply and distribution problems*

### Offers Informative Booklet for Step-by-Step Action at the Local Level

Here's help for you and everyone else directly concerned with the supply, treatment and distribution of water—help that will acquaint the people in your town with the vital importance of this growing problem.

On the opposite page you see the first in a series of advertisements, this one appearing in February *Reader's Digest*. Placed by the Cast Iron Pipe Research Association, these striking advertisements point out to Mr. and Mrs. America how much we depend on a good water system and why we can no longer take it for granted.

Similar advertising will appear regularly this year in *U. S. News & World Report, Nation's Business, Better Homes & Gardens, American Home* and *Sunset* magazines to carry this public service message to millions of community leaders and homeowners.

### Free Local Plan-of-Action Booklet

These ads offer a free booklet telling about the water problem. It shows how responsible citizens can acquaint themselves with the needs of their community. It also gives a step-by-step outline of action, telling how they can help their officials extend and improve the local water system through more adequate rate structures or financing.

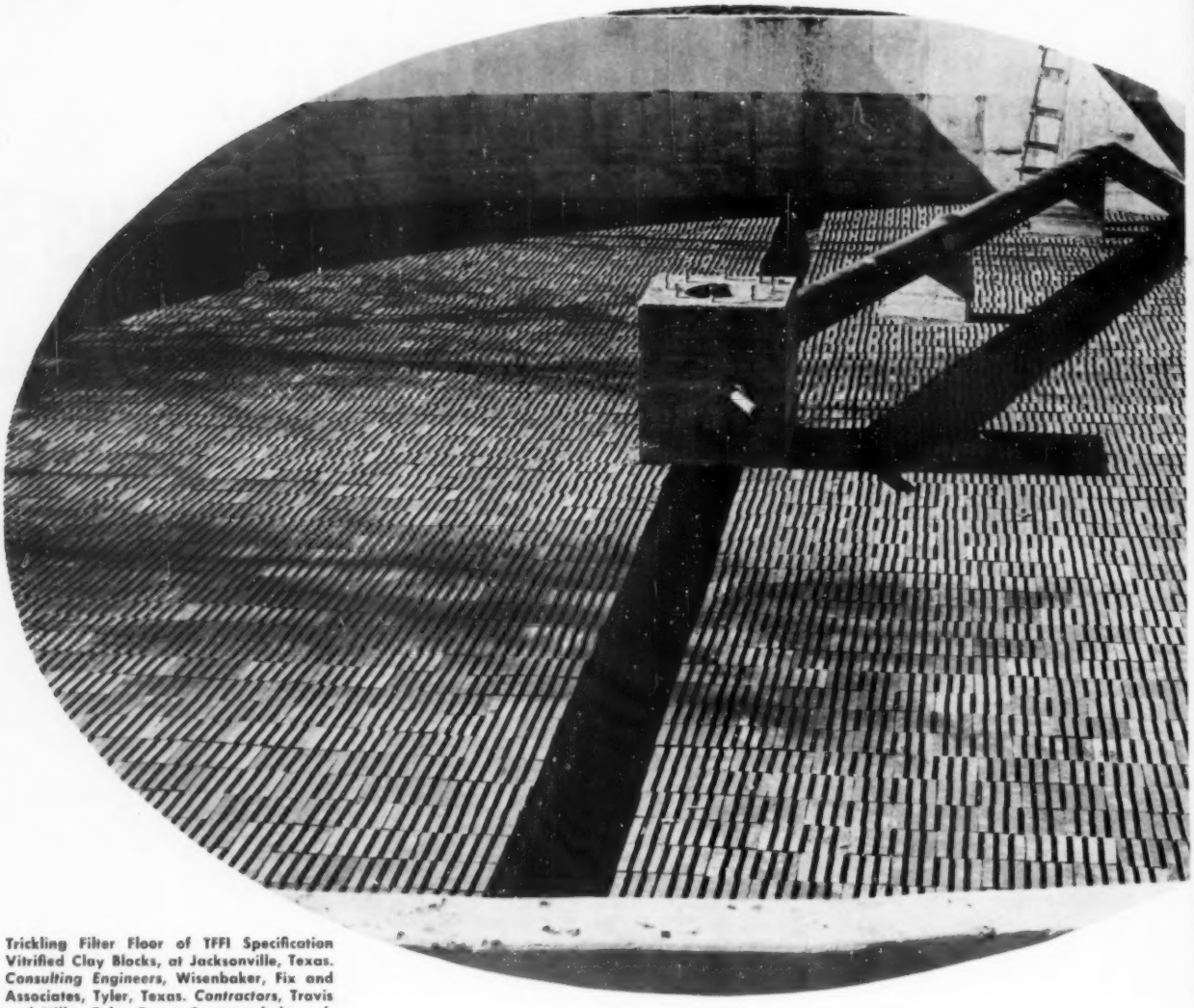
We'll be happy to send you a free copy of this new booklet. Write to Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Ill.

*THREE REASONS WHY* CAST IRON PIPE IS *AMERICA'S GREATEST WATER CARRIER:*

1. More miles of underground cast iron water mains are now in use than of all other kinds of pipe combined.
2. More miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.
3. Impartial surveys prove that today's water utility officials and consulting engineers prefer cast iron pipe for underground water distribution by an overwhelming majority.

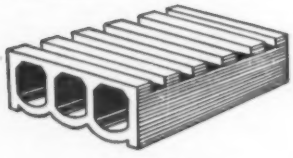
**CAST IRON PIPE**

# *Guarantee the long term success*

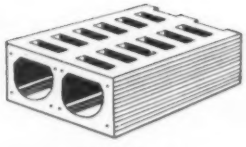


**Trickling Filter Floor of TFFI Specification Vitrified Clay Blocks, at Jacksonville, Texas. *Consulting Engineers*, Wisenbaker, Fix and Associates, Tyler, Texas. *Contractors*, Travis and Miller, Tyler, Texas. Screens, sludge collectors by *Link-Belt* Co. Filter distributors and digester equipment by *Ralph B. Carter* Co.**

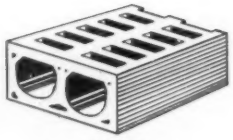
## TFFI TRICKLING FILTER



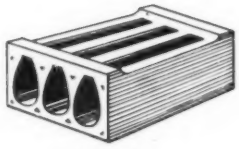
**TRANSLOT**
Texas Vitrified Pipe Co.
Mineral Wells, Texas



**ARMCRE**
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



**BOSCO**
Bowerston Shale Co.
Bowerston, Ohio



**NATCO**
Natco Corporation
Pittsburgh 22, Pa.

*of your Trickling Filters with*

# the Floor Blocks of TFFI SPECIFICATION VITRIFIED CLAY

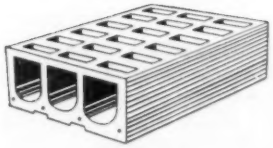
## The Most Important Part

Of a trickling filter is the underdrains. When built of vitrified clay to TFFI specifications, they will safely carry highest hydraulic loadings; and they alone can withstand all the ravages of acids, alkalis and bacterial action. They are made in modern plants under rigid controls of quality that are impossible with any substitute material. Only they offer you a 50-Year Guarantee against damage by acids and bacteria. *Plus* long-term low cost, higher velocity flow, maximum ventilation and crushing strength, light weight and ease of laying.

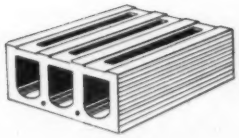
## Leaders in Ending Stream Pollution

TFFI takes pride in its contribution of superior filter floors toward clean waters in America. Over 35% of the population is now served by 2,682 sewage works with trickling filters. *The six greatest advantages of these filters are:* low initial cost, low operating cost and long term maintenance costs. Overloads are no problem and operating personnel is at a minimum.

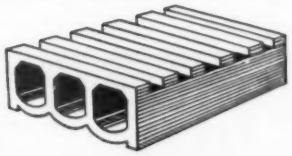
# FLOOR INSTITUTE



**DICKEY**
W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.



**POMONA**
Pomona Terra-Cotta Co.
Pomona, No. Car.

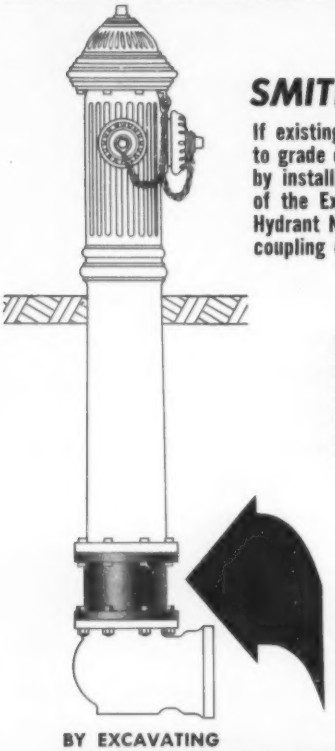


**TRANSLOT**
Cannelton Sewer Pipe Co.
Cannelton, Ind.

# *Grade changes caused this.*

## *HERE IS HOW SMITH HYDRANTS CAN BE EXTENDED*

**If existing Fire Hydrant Nozzles and Caps are not readily accessible due to grade changes this condition can be quickly and economically corrected by installing Hydrant Standpipe Extensions as illustrated. The installation of the Extension will provide clearance between the groundline and the Hydrant Nozzles permitting the free rotation of the wrench and the quick coupling of fire hose to existing Hydrants.**



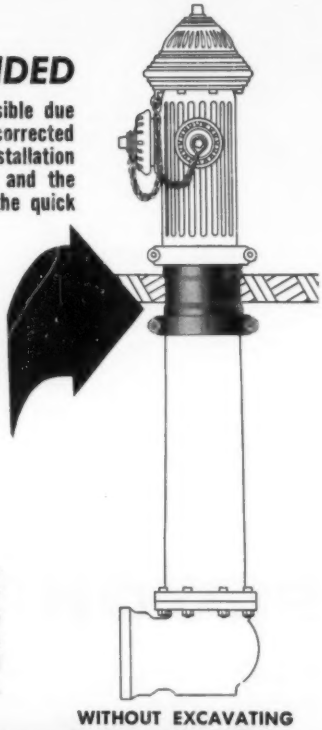
BY EXCAVATING

### PROTECTOP HYDRANT

**Depth of bury can be increased by installing Standpipe and Main Valve Rod Extensions at the groundline between the Upper and Lower Sections. This construction permits installation of the Extension without excavating and the reuse of the original Hydrant internal operating parts. The Extensions are produced in 6″ increments.**

### ONE PIECE STANDPIPE OR TWO PART HYDRANT

**After the Standpipe is excavated the extension is installed between the bottom of the Standpipe and the Hydrant Elbow. The depth of bury is increased by the desired amount reusing the original operating parts. The Extension thread accepts the original Main Valve Rod assembly. The Extensions are produced in 6″ increments.**



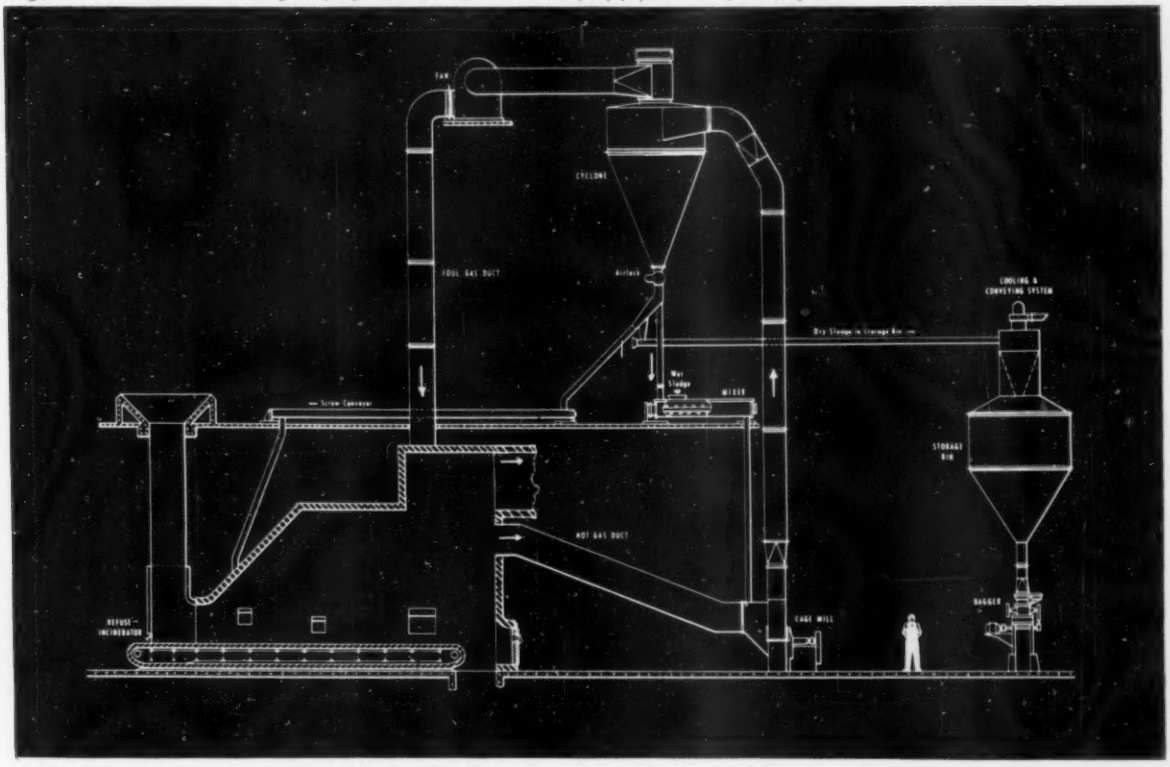
WITHOUT EXCAVATING

FIRE HYDRANTS · VALVES · SINCE 1896

## THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

Consulting Engineers: Consoer, Townsend & Associates, Chicago
Contractors: Fruin-Colnon Contracting Company and C & C Construction Company (a joint venture) Fort Wayne, Ind.




Typical arrangement of C-E Raymond Flash Drying System for sludge disposal combined with a refuse incinerator incorporating the C-E Traveling Grate Stoker. No-cost heat from the incinerator is used to dry sludge filter cake.

# NEW ALBANY, INDIANA chooses C-E

- *for sludge disposal*
- *for refuse incineration*

To meet growth and expansion needs, the City of New Albany has embarked on a $4,200,000 program of sewerage improvement which includes a new primary treatment plant with an average influent flow of 6.13 mgd. Sludge filter cake here will be reduced to approximately 8 per cent moisture content in a C-E Raymond Flash Drying System. *No-cost* heat for drying will be supplied by two 80-ton daily-capacity refuse incinerators using the most modern of refuse firing devices – the C-E Traveling Grate Stoker.

Both of these C-E Systems have been service-proved in installations large and small, and are a combination which furnish a dependable, economical solution to a community's sewage-refuse disposal problem. Not only does the refuse incinerator furnish heat for sludge drying, but the dried product, if not contaminated by industrial wastes, can be sold for use as soil conditioner to help defray plant operating expenses. At New Albany, the Flash Dried sludge will be used as soil conditioner, with any excess being burned in the refuse incinerator.

If your community's needs, now or in the future, call for improved sewage disposal facilities, alone or in combination with refuse disposal, investigate the C-E Raymond System. For detailed information on how this system can benefit your community, contact the C-E office nearest you. Our specialists will be glad to discuss, at no obligation, your requirements with you or your consultants.

**MORE SEWAGE SLUDGE IS DRIED AND/OR BURNED IN THE C-E RAYMOND SYSTEM THAN IN ALL OTHER SYSTEMS COMBINED.**

**COMBUSTION ENGINEERING**

**RAYMOND DIVISION, 1315 North Branch Street, Chicago 22, Ill.**
**Eastern Office:** 200 Madison Avenue, New York 16, N. Y.
**Western Office:** 510 West Sixth Street, Los Angeles 14, Calif.

C-182

**ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL**

CATERPILLAR'S PROJECT PAYDIRT

***PROJECT PAYDIRT** pays off for you*

# NEW CAT D8

## PUSHLOADING: PRODUCTION UP

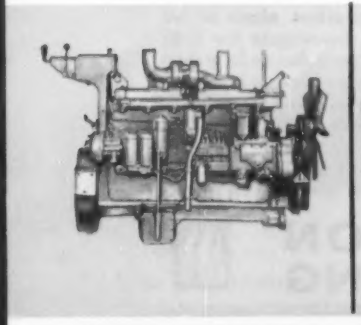
The new Caterpillar D8 Series H Tractor is ready *now* to increase its lead as undisputed king of its size class. A major achievement in Caterpillar's all-out research program, "Project Paydirt" (see box), the new D8 has been proved through a rigorous field testing program.

This D8 is new in design, appearance and performance. It is bigger, more powerful. It incorporates new engineering advances. It is easier to operate.

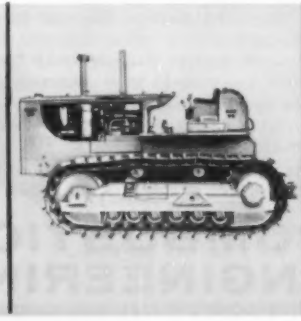
*Now—what can it do for you?* Here's the answer:

The D8 has been thoroughly field tested on actual jobs. Several of the big new tractors have been at work constantly in every kind of material. Out of the statistics developed, both pushloading and bulldozing production figures are *up*.

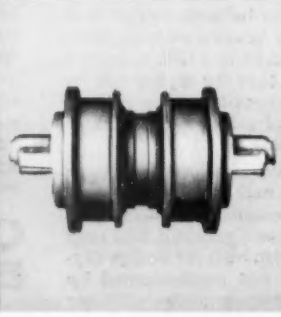
This means that you can move dirt faster and cheaper than ever before with a tractor in this size class. You



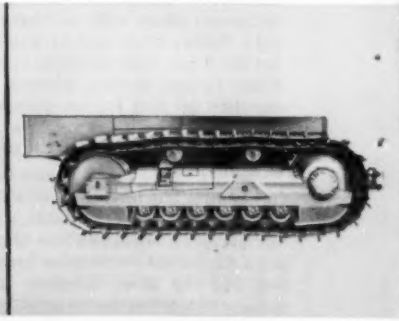
**HORSEPOWER INCREASED 18%.** The horsepower of the new D8 is up from 191 to 225 at the flywheel, from 155 to 180 at the drawbar. In addition, engine torque rise now is 20%, an increase of one-third. Over-all engine performance has been greatly improved by the addition of a turbocharger.



**SIZE INCREASED.** To make effective use of the new horsepower, over-all weight of the tractor has been increased 4,400 lb. to a total of 47,000 lb. At the same time the gauge has been increased to 84 inches, track on ground lengthened to 114 inches, square inches of contact increased to 5,505.

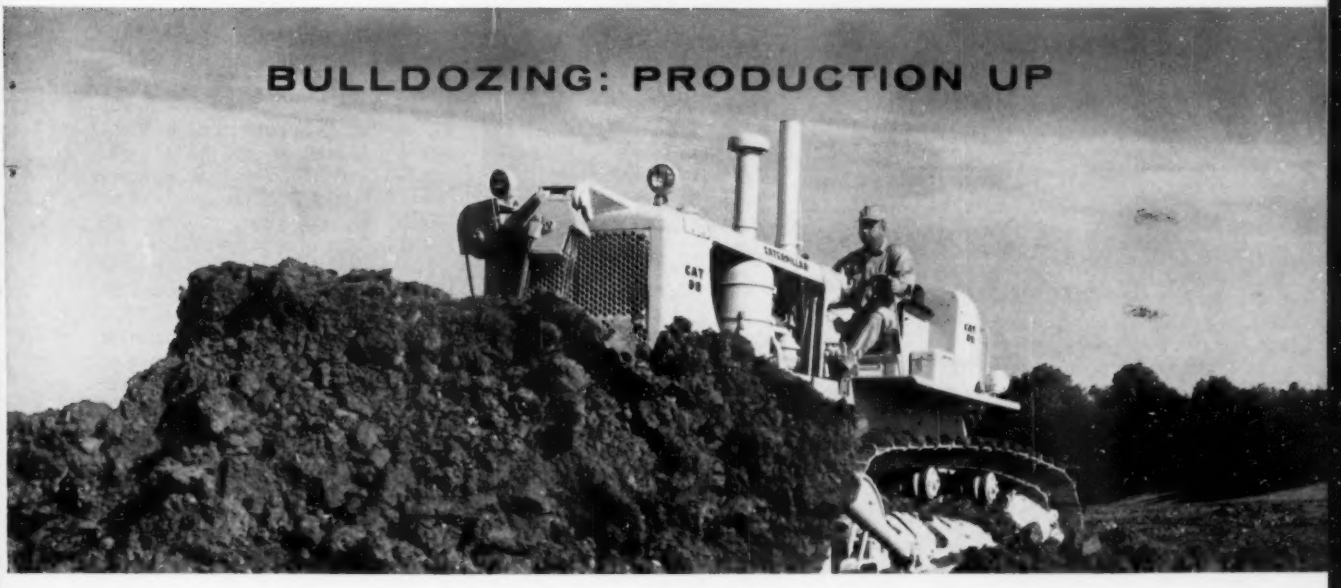


**LIFETIME LUBRICATED ROLLERS AND IDLERS.** That's right—lifetime! In a major research breakthrough, Caterpillar has achieved track and carrier rollers and idlers that never require further lubrication until rebuilding. And service life is hundreds of hours longer than with ordinary rollers.



**NEW, STRONGER, HEAVIER UNDERCARRIAGE.** Every component, such as frames, links, braces, pins, bushings, shoes, has been made stronger by the use of improved materials and heat treat processes to provide longer life. And ground clearance has been increased 50% to almost 20 inches.

# SERIES H TRACTOR




get higher production, bigger profits—yet the new D8 is actually *more economical* to own and operate!

But find out for yourself. Get the full story from your Caterpillar Dealer, all the eye-opening facts and figures that can only be touched on briefly here. Then *see* this great new machine at work on your operation as soon as possible. You can't afford not to!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

**CATERPILLAR**

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**BORN IN RESEARCH... TESTED IN THE FIELD**

**DRY-TYPE AIR CLEANER.** Here's still another major Caterpillar research development on the new D8—the new dry-type cleaner which removes 99.8% of dirt in the intake air, even under severe operating conditions. The new cleaner can be serviced in 5 minutes, costs a good deal less to use.

**SUPERIOR OPERATION.** Operator visibility is excellent because of higher deck and changed seat position. Console-type controls make operator's job easier. And on torque converter models, standard foot-operated decelerator can override hand throttle—free operator's hands for other controls.

## TWO MORE IMPORTANT OPERATOR CONVENIENCES

**HIGHER SPEED.** Completely new, long-life, direct drive transmission provides six speeds forward and six reverse. High speed has been increased to 6.3 MPH forward, 6.4 reverse to reduce cycle time. Operator can shift from any forward gear into a similar reverse gear (or vice versa) by simply moving the forward-reverse lever.

**DEPENDABLE OIL CLUTCH.** By contractor and operator demands, the virtually service-free, easy-to-operate oil clutch has been retained in the new D8. Another important Caterpillar exclusive.

CATERPILLAR'S **PROJECT PAYDIRT**

***PROJECT PAYDIRT:*** Caterpillar's multi-million-dollar research program—to meet the coming challenge of the greatest construction era in history with the highest production earth-moving machines ever developed.

Operator George A. Miller, Sr., has plenty of visibility to keep his broom hugging the curb as he easily makes a tight turn with his Model 40 Austin-Western sweeper at a Danville street corner.

# Austin-Western Sweeper saved $4950 in 12 months for Danville, Pa.

*—says City Engineer F. O. Yohn, Danville, Pa.*

Danville, Pa., replaced its push cart, broom and street sweeper with a new Model 40 Austin-Western sweeper. It was City Engineer F. O. Yohn who selected the A-W for Danville after a careful study of all motorized sweepers.

**Compares sweeping costs**

Mr. Yohn says, "I kept a careful check on costs with A-W sweeper and compared them with previous costs of sweeping by hand. The Model 40 Austin-Western sweeper saved us $4950.10 in 12 months!

"I particularly like the visibility and maneuverability afforded by the Austin-Western. It's easy for the operator to see his broom at all times. He can steer and sweep closer to curbs and parked cars. It's hard to see over the hopper in front on competitive models.

**All other sweepers obsolete**

"As far as Danville's concerned, Austin-Western's superior performance makes all other sweepers obsolete!"

There are two A-W sweepers available to meet your precise needs—Model 40 (2 cu. yd.) and Model 60 (4-plus cu. yd.) A-W sweepers go anywhere to get dirt everywhere—cities and towns, parks and zoos, highways, factories and airports.

Learn today why the full vision front steer, 3-wheel design, maneuverability and rear dump features of A-W sweepers are so popular! See your nearby A-W distributor or write us direct.

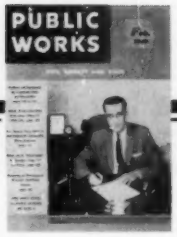
Operator demonstrates rear dump feature, hydraulically controlled from driver's seat, that lets you dump and drive away in less than a minute.

Austin 100th YEAR Western

CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes


**Wylie W. Gillespie,** partner in the consulting firm of Smith and Gillespie, Jacksonville, Florida, is executive administrator of approximately $30,000,000 of engineering annually. His chief interest for many years has been in the sanitary field; however, his firm also engages extensively in electrical, mechanical, structural and highway projects.

Mr. Gillespie became registered in Florida as a Civil Engineer in 1929 and as a Land Surveyor in 1931. He began his professional practice in Lake County as County Surveyor and County Engineer and subsequently began operating independently, primarily in water and sewage works. In partnership with W. Austin Smith, the firm of Smith and Gillespie was formed in 1940. In September of that year, the firm met its first challenge with a topographic survey of the site for Camp Blanding, consisting of 12,000 acres to be completed and final topo maps delivered in three weeks. This almost impossible job was successfully completed. It was followed by a succession of defense work contracts on air bases in Florida, Georgia and South Carolina.

After the war, the firm expanded to an engineering organization of 50 to 150 men who work on design and supervision of twenty to thirty projects annually, ranging up to the $20,000,000 program at St. Petersburg now nearing completion.

Mr. Gillespie is a registered engineer in Georgia, South Carolina, West Virginia, Louisiana and Florida and holds a National Bureau of Registration Certificate. He is a Fellow and past president of the Florida Engineering Society and past president of the Florida State Board of Engineering Examiners. He is a member of the ASCE, the AAE, the SAME and a former national director of AWWA, receiving the George Fuller Warren Award in 1957. He is a member of the Florida SIWA and director - at - large of the FSIWA. His firm of Smith and Gillespie, Engineers, maintains permanent area offices at St. Petersburg and Hollywood, Florida.

POWERS American

SERIES LM-4

# "Load-Master"

## HYDRAULIC CRANE

**Saves time and manpower because it speeds up loading and unloading jobs... handles work normally requiring several specially-equipped vehicles.**

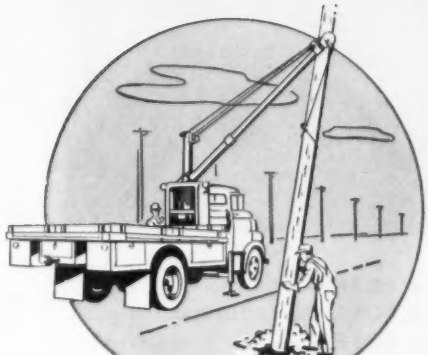
Load-Master lifts a 4000 lb. load with ease... moves it safely and quickly under the most adverse job conditions. Power is derived from a heavy-duty hydraulic pump driven by the truck engine. Controls are located in a position which gives operator full view of the crane at all times.

Operator has absolute control of load at all times. The hydraulic system requires intentional movement of control levers before load position can be changed... and the load cannot drop if the truck engine stalls.

OPERATING FEATURES: Telescopic-type hydraulic boom can be spotted at any point from horizontal position to an 85° angle of elevation; hydraulically-powered mast will turn 360° in either direction; specially-designed winch, driven by a hydraulic motor, is grooved to wind cable evenly; hydraulic outriggers, with swivel-mounted foot plates, furnish extra side stability.

Load-Master is ideally suited for use with the Powers-American Series 300 Body shown above. It can also be furnished with bodies of other types... or shipped for mounting in your shop or local garage.

**PRICE INFORMATION AND DESCRIPTIVE LITERATURE WILL BE SENT UPON REQUEST.**



Load-Master can be used for setting poles up to 45′ in length. It requires only 20″ of mounting space behind the truck cab. Boom extensions to 22′ can be furnished.

## McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY
ST. LOUIS 15, MO.

625 CEDAR STREET
BERKELEY 10, CALIF.

# FILTER SAND AND GRAVEL

A high grade of silica material hydraulically produced to meet specifications for effective size uniformity coefficient and exacting chemical requirements.

Prompt shipments from plants located in Roslyn, N. Y., and Port Jefferson, N. Y.

***William J. McCormack Sand Division***

***Penn Industries, Inc.***

**136 East 57th St., New York 22, New York**

MUrray Hill 8-9200

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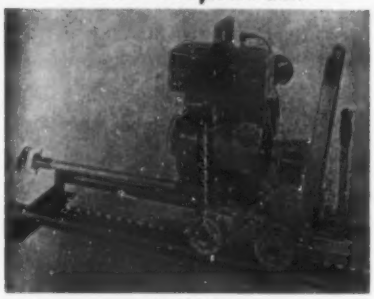
**EBMI**
**Underground Boring Machine**
***New! Improved!***



Model 70

- **BORES**—with no surface break
- **BORES**—up to 250 feet in length
- **BORES**—up to six inches diameter
- **BORES**—so drill stem of pipe of conduit stays
- **BORES**—1,000 feet on 1 Gal. of gas
- **REAMS**—up to 12 inches diameter

***Write immediately for information.***

EBMI

**EARTHWORM BORING MACHINE, INC.**

**P. O. Box 1100**
**Santa Monica, California**

### REGULATING FLOOD PLAIN DEVELOPMENT

This is Research Paper No. 56 of the Department of Geography of the University of Chicago, Chicago, Ill. Prepared by Francis C. Murphy, it is the result of a 9-month library and field research project. The intent is to indicate the present status of developments in this field and to offer constructive suggestions for flood plain developments which are sometimes unwise and hazardous. The text, which is planographed and contains 204 pages, is well written and illustrated. No price is given. The bibliography is also excellent. Recommended reading for anyone who has a flood plain problem. For information on how to get a copy write Mr. Murphy.

### CHANGES IN URBAN OCCUPANCE OF FLOOD PLAINS

This is Research Paper No. 57 of the Dep't. of Geography of the University of Chicago, Chicago, Ill. It was prepared by Gilbert F. White, W. C. Calef, J. W. Hudson, H. M. Mayer, J. R. Sheafer and D. J. Volk. Planographed; 235 pages; 83 illustrations; no price given. For information on how to get this text, write the University of Chicago Press. The book deals with the dimensions of the urban flood problem, and the programs in connection with it; the number and size of places having flood problems and the damage potential; what has been done; and a discussion of the geographic grounds for public action. Like its companion publication, Research Paper 56, it is an excellent and valuable job.

### SEWERAGE AND SEWAGE TREATMENT

The eighth edition of a book first appearing in 1922 has a co-author. E. Robert Baumann, Professor of Civil Engineering, Iowa State College, joins the original author, Harold E. Babbitt. While the chapter and paragraph arrangements have not been reorganized, the text has been subjected to somewhat extensive scrutiny and revision. This is evident from the abundant references to technical articles from magazines which are dated through 1957. The preface points out that the book is "somewhat of a review of literature and provides an open sesame to the researcher . . ." The eighth edition contains 116 more pages than the 5-year old seventh edition, bringing the total to 790. Much of the added space is devoted to more illustrative material, with liberal use of drawings from manufacturer's literature. Tables are employed more extensively than heretofore, with some compiled by the authors, combining data from several article sources. Other features that update the text are the use of standard units of expression recommended by the FSIWA Committee and the terminology of the 1955 edition of "Standard Methods." The Appendix is made up of problems, as in previous editions, but about half of them have published answers in this edition. The publisher is John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. The price is $10.75.

### GUIDANCE TO LIGHTING OF HIGHWAYS

The Safe Highway Lighting Committee of the Street and Highway Safety Lighting Bureau announces publication of the "Highway Lighting Reference Guide." The publication gives, for the first time in printed form, a complete engineering guide on where and how our nation's highways should be lighted. The book first reviews in detail light sources available, discussing incandescent, mercury and linear fluorescent lamps with appropriate illustrations and tables. A second section, devoted to luminaires, reviews fundamentals of design, elements used, light distribution, common types in use, quality specifications, standards and tests, installation and maintenance. Lighting supports, power distribution and series and multiple hook-ups are also evaluated. Lengthy discussion, with complete position diagrams, is given to intersections and interchanges, connections to service areas, elevated and depressed expressways, tunnels and underpasses, minimum average illumination levels for tunnels, day-time entrance lighting for traffic tunnels, bridges, overpasses and viaducts, high traffic density sections, curves and hills, railroad grade crossings and urban area approaches. Copies are available at $1 each from the Safe Highway Lighting Committee of the Street and Highway Safety Lighting Bureau, 1400 Terminal Tower, Cleveland, O.

# Now—That's What I Call the **Right Approach** to PROFITABLE UTILITY EQUIPMENT

**The Davis 210 Backhoe on a Work Bull 202—the only machine in the world that can dig flush alongside a wall.**

***Take it from customers who know:*** The M-F Work Bull 202 and Davis Loader-Backhoe are matched to give you the most economical use of power and maximum on-the-job production. Jobs keep moving and profits keep multiplying.

The same rig, the same operator are busy from start to finish — trenching, loading, lifting, backfilling, stockpiling, cleaning up, or doing scores of other jobs with numerous quick-change attachments. Look at the manhours you save.

You get features you can't even buy on other outfits — flush digging, sure-footed lugging power, the famous Ferguson system, plus the "never-duplicated" Davis Loader. If you are profit conscious you can't afford to be without it!

Other M-F Industrial Products are designed with the same approach, and your Massey-Ferguson Dealer can help you select the right rig — at the right price. He'll back it up with service, too. Write today for literature and his name and address.

Work Bull 100† Work Bull 303 with 500 Loader and Davis Backhoe Work Bull 202 with Davis Loader and Backhoe Work Bull Fork Lift

# MASSEY-FERGUSON INDUSTRIAL DIVISION

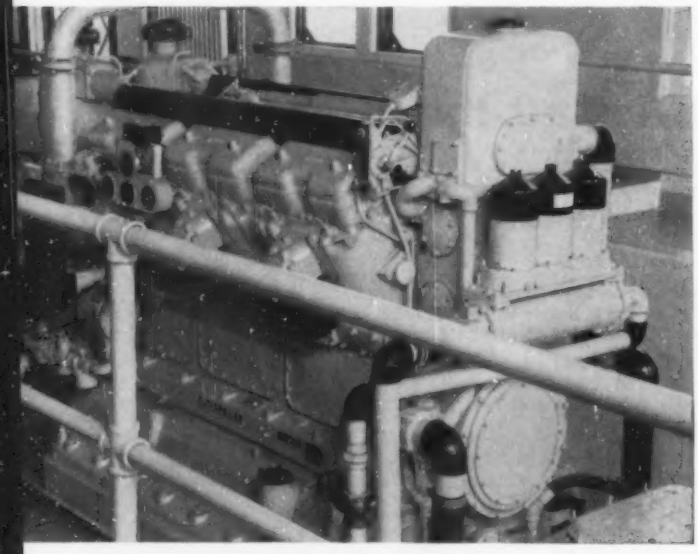
**1009 SOUTH WEST STREET • WICHITA 13N, KANSAS**

# engine power
## BY CATERPILLAR

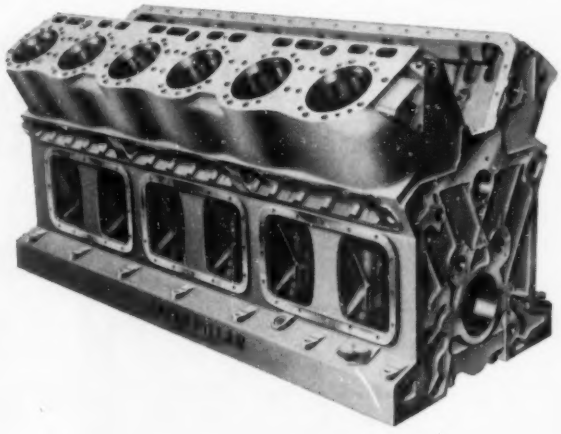
# FROM FOUNDATION UP, CAT DIESELS ARE MODERN HEAVY-DUTY ENGINES!

In more than a quarter century of diesel leadership, Caterpillar has pioneered advance after major advance into its great engines. From foundation up, they incorporate the latest developments of design and manufacturing techniques. As a result, on installation after installation, they have established outstanding records for economy, dependability and long life. Cat Engines are available up to 650 HP (maximum output capacity)—Electric Sets up to 375 KW (standby rating). They are honestly rated and certified for capacity. Let your Caterpillar Dealer, a power expert, help you select the unit that meets your needs most economically and efficiently! He has a complete line of Cat Diesels.

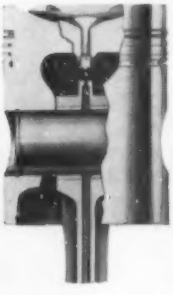
Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.



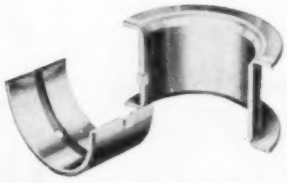
**City of Wildwood Pumping Station, Rio Grande, New Jersey, relies on this Cat Engine (327 HP output) to furnish all power for water pumpage. The station serves Wildwood, Wildwood Crest, Rio Grande and adjacent communities. The Caterpillar Engine pumps from 5 to 7 million gallons rate of water per 20-hour day, 7 days a week, during the summer.**



**A firm foundation. Strong, rigid support for all parts of Caterpillar Engines is provided by a unit-cast crankcase and cylinder block. Internal walls give extra support for the bearings and add rigidity to the block. Careful control, modern processing and rigid inspection in Caterpillar's own foundry insure a perfect foundation for every Cat Engine.**



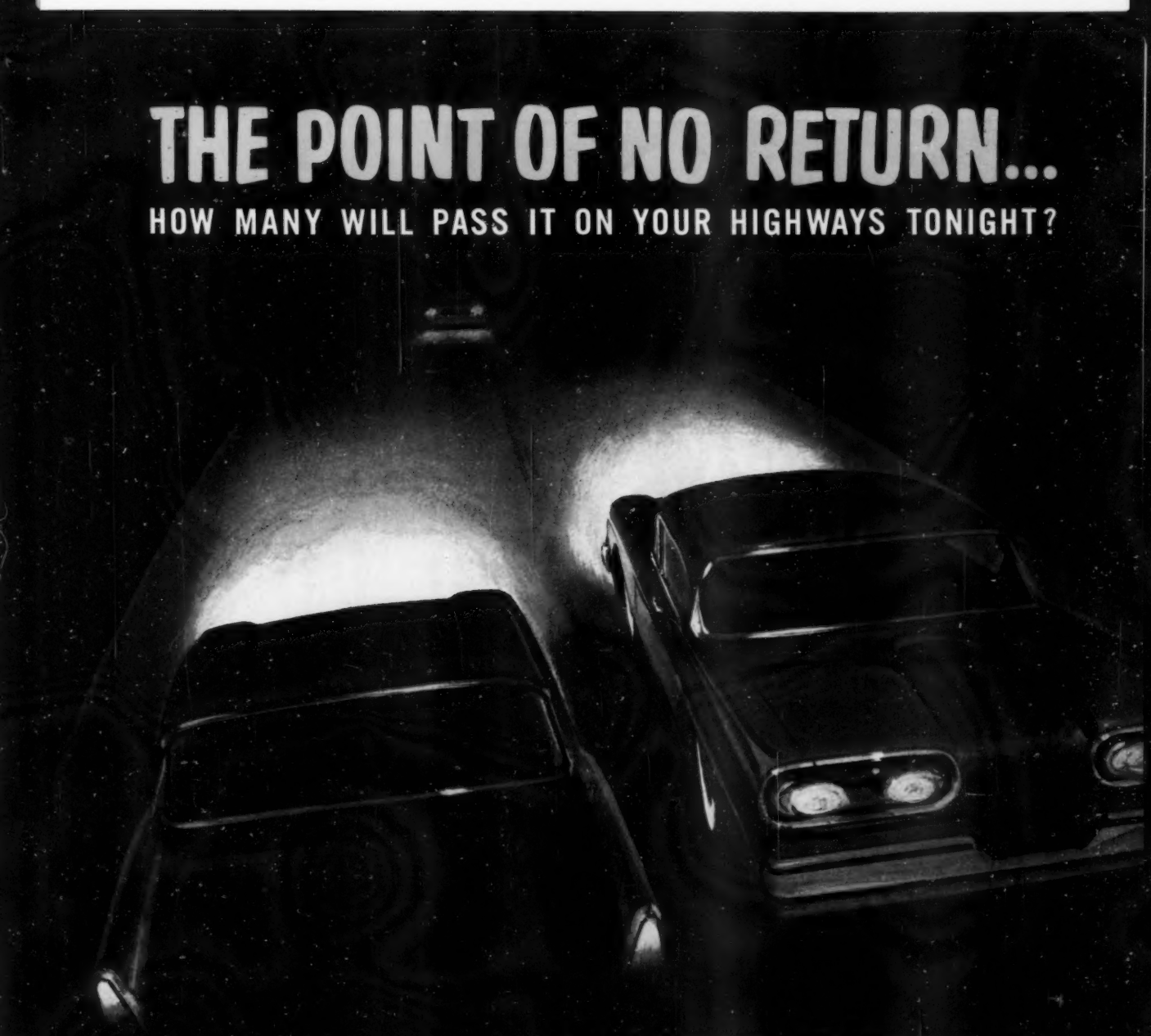
**HEAVY-DUTY PISTONS. Pistons in every Caterpillar Engine combine the light weight of aluminum, the durability of cast iron, the heat resistance of stainless steel and the wear resistance of chromium. All add up to savings for you through a long life of efficient operation with low maintenance costs.**



**STEEL-BACKED BEARINGS. Steel-backed aluminum bearings are the finest available. Proof: Many Cat Engines have operated for more than 20,000 hours and are still using their original bearings. Chief reason for their long life is their ability to resist acids normally found in engine crankcases.**

# THE POINT OF NO RETURN...

## HOW MANY WILL PASS IT ON YOUR HIGHWAYS TONIGHT?



A barely defined center line . . . the absence of a no passing stripe . . . and a motorist commits a fatal error of judgment. Unaware of the sharply dipping roadway and the oncoming car it conceals, he makes his move. In the next instant, the approaching auto is revealed . . . too late . . . he has passed the point of no return.

Properly laid pavement markings reflectorized with Cataphote Waterproof Reflective Traffic Beads can materially reduce night-time traffic fatalities . . . in fair weather and foul. Many traffic engineers consider Cataphote Waterproof Beads one of their staunchest allies in a never-ending struggle to make streets and highways safer. And . . . a nationwide network of Cataphote Supply Centers assures them of prompt delivery . . . anytime . . . anywhere.

As long as there are roads to drive upon, drivers will err in judgment. Realizing this, the wise traffic engineer uses every means at his command to make existing highways safer. The man who fails to do so, commits the gravest error of all.

Cataphote
CORPORATION

TOLEDO 10, OHIO / JACKSON, MISSISSIPPI

*Manufacturers of* CATAPHOTE REFLECTIVE BEADS • CATAFLEX REFLECTIVE COATING • CATALINE REFLECTIVE STRIPING
CATATHERM REFLECTIVE PLASTIC STRIPING • TRAFFIC SIGNS • STREET NAME SIGNS

**WHEN WATER MEANT DRUDGERY!** The water our ancestors used was as difficult to come by as it was doubtful in quality.

**TODAY'S HOUSEKEEPER,** served by a modern American water system, finds the water she needs—clean pure water—at her fingertips.

**U.S.** Cast Iron **PIPE**

**FOR WATER, SEWERAGE AND**

**U. S. PIPE AND FOUNDRY COMPANY**

# but better than ever today!

**Modern technology plus mine-to-line control insures top quality of U.S. Cast Iron Pipe**

Our water today is made so universally pure and wholesome no American ever doubts its quality.

This is a tribute to the forward-looking water officials who plan and administer the nation's water systems... and their suppliers.

For example, U. S. Pipe controls every step from mining to shipping ... uses every possible quality check to make sure its product measures up to the heavy responsibility placed on it.

This close and painstaking supervision insures the unvarying high quality and dependability of U. S. Pipe—both indispensable to a product that plays so big a part in protecting the nation's health.

**GOOD PIPE BEGINS HERE...** At one of U. S. Pipe's mines near Birmingham, where high grade coking coal, essential to quality, is mined.

**PIPE TAKES SHAPE...** Molten iron in this rapidly rotating mold assumes its form as pipe—one of many manufacturing steps.

**TESTING STRENGTH...** Pipe specimens are periodically subjected to more brutal treatment in laboratory than they will receive in normal service.

**INDUSTRIAL SERVICE** CAST IRON

**Birmingham 2, Ala.** *A wholly integrated producer from mines and blast furnaces to finished pipe.*

# safety everyone can afford

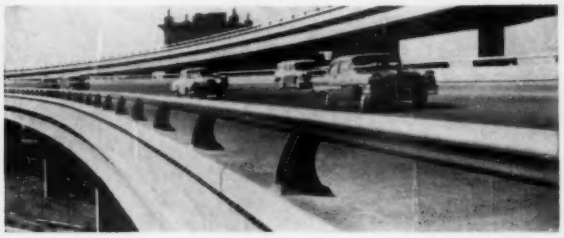
## New Alcoa Aluminum Beam Guard Rail

Alcoa's new aluminum beam guard rail for highways combines maximum safety with modern appearance and minimum upkeep. Fabrication from high-strength aluminum alloys assures increased energy absorptive capacity.

Alclad aluminum provides permanent resistance to corrosion and means direct savings in maintenance costs. It resists the corrosive effects of road salts, industrial fumes and airborne grit. No painting—on or after installation—is necessary. Initial cost, only slightly higher than ordinary guard rail, is rapidly equalized by the savings in painting and other maintenance. Alcoa® Beam Guard Rail is available with aluminum posts, too.

Now is the time to get the full story on Alcoa Beam Guard Rail, Lighting Standards, Highway Signs, Overhead Structures and Chain Link Fencing. To learn how they help stretch taxpayers' highway dollars, call your nearest Alcoa sales office or write: Aluminum Company of America, 1912-B Alcoa Building, Pittsburgh 19, Pennsylvania.

**BRIDGE RAILINGS** of Alcoa Aluminum deliver maximum return for tax dollars, because first cost is last cost. Lightweight aluminum is easier to handle and faster to erect. Corrosion-resistant Alcoa alloys never need maintenance; they end painting costs that commonly run to a dollar per lineal foot per year.



**OVERHEAD SIGN STRUCTURES** eliminate periodic maintenance and the accompanying traffic tie-ups when they're built of Alcoa Aluminum. Tubular truss designs and single-chord spans meet any requirement and their lightness permits faster erection with minimum man power and equipment.

ALCOA ALUMINUM

*Your Guide to the Best in Aluminum Value*

For Exciting Drama Watch **"Alcoa Theatre,"** Alternate Mondays, **NBC-TV** and **"Alcoa Presents,"** Every Tuesday, **ABC-TV**

# How exclusive clam-action "doubles" for yard-full of

## All over town, big-capacity International Drott

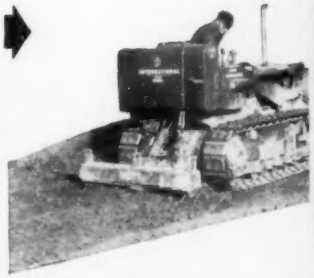
**"Back-dragging" clay by the truckload** with exclusive 4-In-1 clamshell action, this TD-9 4-In-1 reduces the cost of producing street stabilizing material for Sanford, Florida. Inset view shows how 4-In-1 clamshell bottom dumping solves the sticky materials problem—using the double pull of bucket surfaces and gravity for *positive self clean-out!* This 4-In-1 also does city utility, park, and sanitary fill work. "It cuts down on the extra pieces of equipment normally needed, saves time and labor, too," states E. L. Griffith, Sanford's Supt. of Streets and Refuse.

**Get in the driver's seat**—grasp the "machine-selector" lever and see the fingertip ease and speed of instantly putting any 4-In-1 action to work. Count the high-priced machines your city could replace with one International Drott 4-In-1—calculate the thousands of dollars it could save, year after year. Measure the advantage of exclusive pry-action break-out. See what it means to have the exclusive built-in performance protection of shock-swallowing Hydro-Spring. See your International Drott Construction Equipment Distributor for a demonstration of a 4-In-1 on the TD-6, TD-9, TD-14 or TD-20—whichever size fits your particular needs.

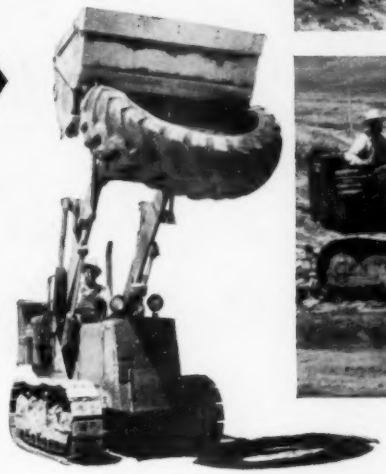
# loader limited-duty rigs!

## 4-In-1 gives versatility unlimited!

**It would take a full-sized blade outfit**—and a good one—to match the material-digging, earthmoving performance of the 4-In-1 as a bulldozer. This TD-6 4-In-1, owned by Bessemer City, North Carolina, is opening up a new street. Rear view shows how the unit's scarifier attachment is used to shatter dry, "rock-solid" hardpan for fast loading. Bessemer City also uses this 4-In-1 to clear land for streets and to handle the sanitary landfill.



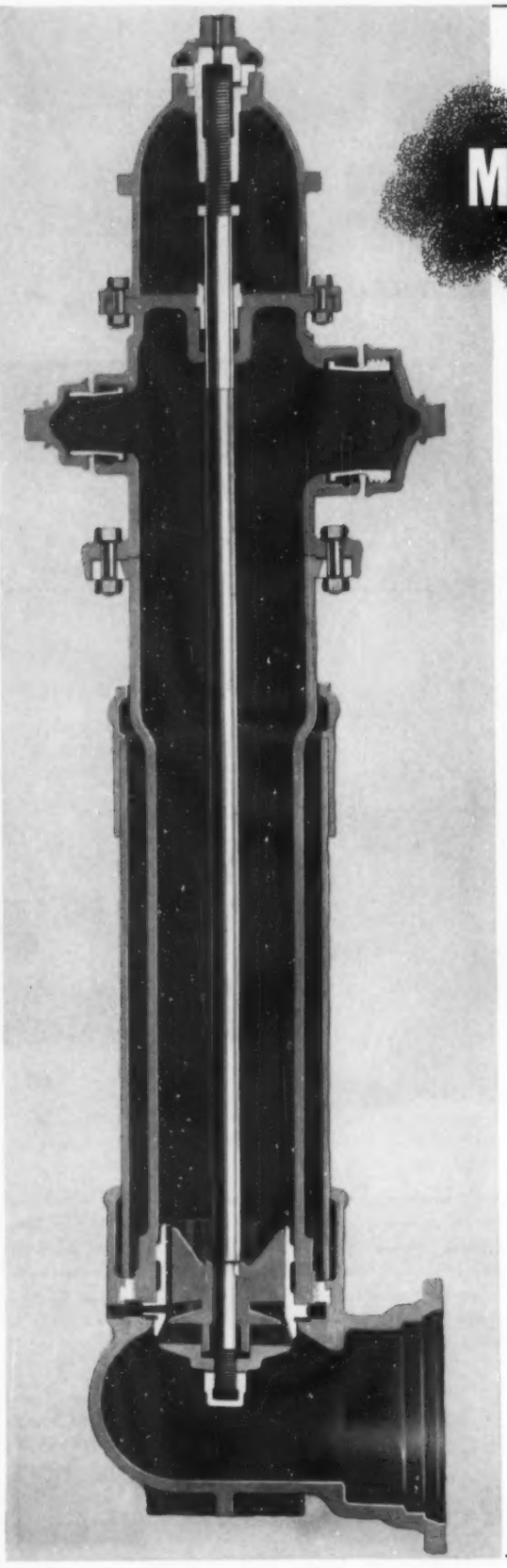
**Put a uniform "cover" over refuse** by simply regulating clam lip opening to 4-In-1 speed—without disturbing a single piece of compacted waste! Disposal Service Co. uses this efficient TD-6 4-In-1 to "keep house" on a big sanitary landfill for Colorado Springs refuse disposal. *"We would need twice as big a machine of any other type,"* states owners Ray Brent and Harry Drysdale: "The TD-6 4-In-1 easily keeps ahead of the mass of refuse 16 big trucks deliver—and keeps the landfill in such good condition, we and Colorado Springs are proud of it." Other view shows how their 4-In-1 "clams" on to tires or other bulky objects, for easy, speedy disposal!



**Culvert maintenance or replacement** is done in minutes—with this clam-type machine that is excavator-loader, clamshell, "carry-type scraper" and bulldozer, all in one mobile, powerful package! The TD-9 4-In-1 is "culvert trouble-shooter" in a cloudburst wash-out area bigger than Rhode Island—Douglas County, Washington, in the Cascade foothills! Inset shows how outfit is rushed by truck to repair a wash-out!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL®
DROTT®



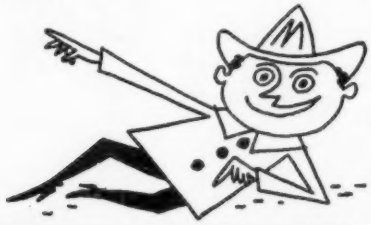
# MATHEWS HYDRANTS

**THE MATHEWS MODERNIZED HYDRANT SUPPLIES THE 4 FUNDAMENTAL REQUIREMENTS FOR EFFECTIVE COMMUNITY PROTECTION**

**and many other quality features, too**

- Replaceable barrel for maximum efficiency—quickly replaced in case of accident without excavating
- Head revolves 360°; simply loosen bolts and rotate
- Stuffing box plate cast integrally with nozzle section—eliminates extra part and provides positive, leakproof construction
- Operating thread, protected by stuffing box plate, operates free of rust, sediment and ice

Also . . . Nozzle sections supplied with hose or pumper outlets as specified • Operating thread cannot be bent • Compression-type main valve prevents broken Mathews from leaking • Nozzle level can be raised or lowered without excavating • Bell, mechanical-joint, or flange-type pipe connections • Conventional or "O" ring packings

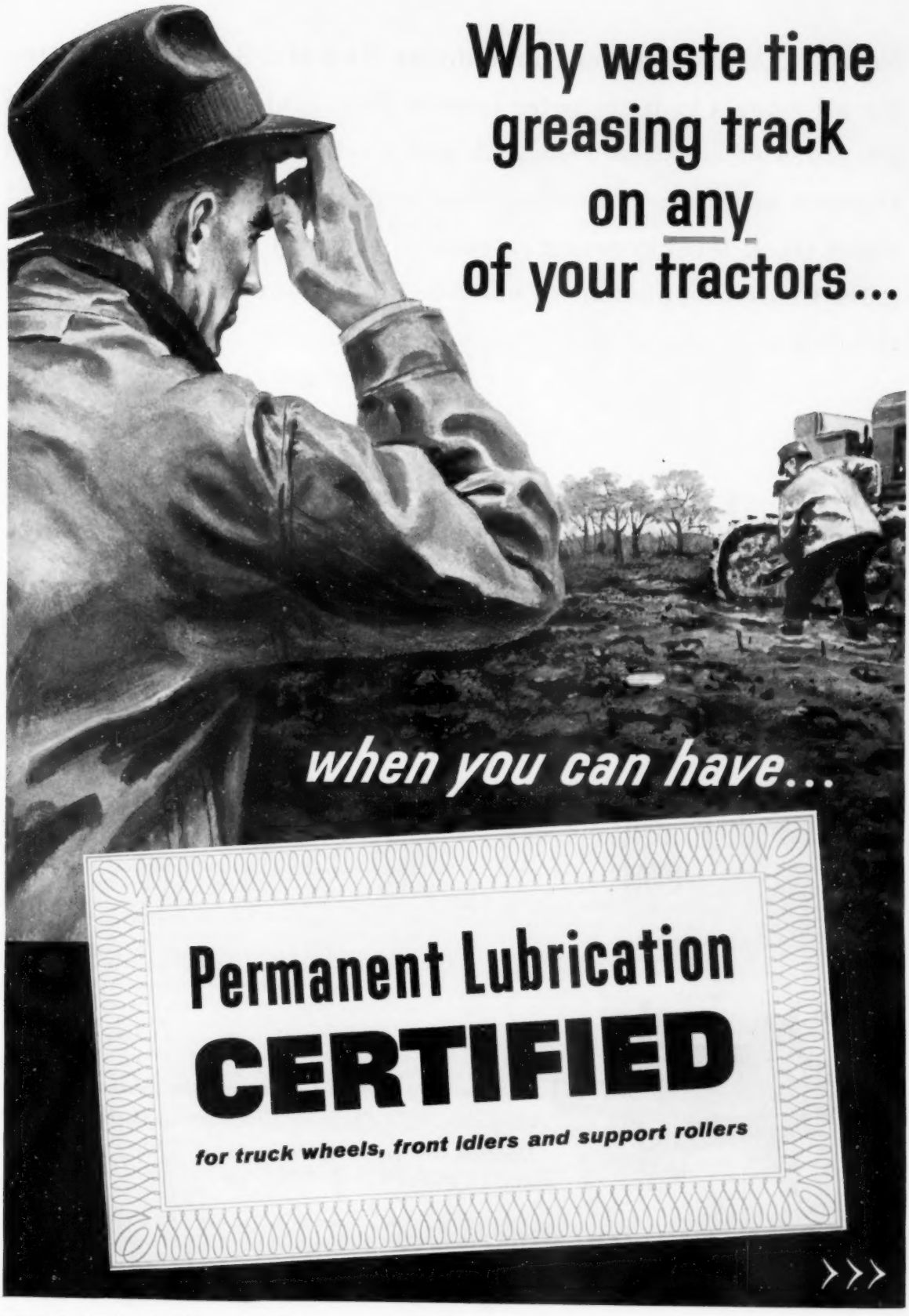


**Made by**

**R. D. WOOD COMPANY**

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

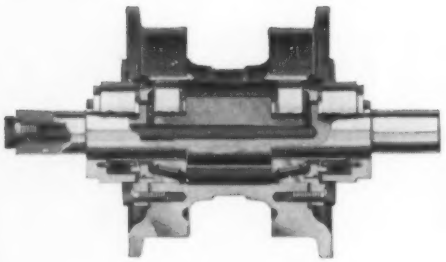

Why waste time greasing track on any of your tractors...
when you can have...
Permanent Lubrication
CERTIFIED
for truck wheels, front idlers and support rollers

**Now . . . Allis-Chalmers announces PERMA-SAFE lubrication for all models in its crawler tractor line . . . climaxing more than 20 years of constant research and on-the-job experience with Positive Seal, tapered roller bearing design. Now you can forget about track-level greasing . . . convert that lost time to profit time. Allis-Chalmers, pioneer of extended lube intervals, lets you take this big step ahead with complete confidence.**

# Permanent Lubrication CERTIFIED

The Positive Seal AC PERMA-SAFE Wheel

*for truck wheels, front idlers and support rollers on all models of Allis-Chalmers crawler tractors*



*See your nearby Allis-Chalmers dealer for the full story now. Allis-Chalmers Construction Machinery Division, Milwaukee 1, Wisconsin.*

**move ahead with ALLIS-CHALMERS**

**. . . power for a growing world**

# NOW...

## cut new filtration plant costs 45%

## Increase clear water capacity 100%

## Specify Celite diatomite filtration

You can now double the potable water capacity available to your growing community and cut the installation cost of new filtration nearly in half. How? Specify diatomite filtration. You'll reduce land and construction costs because diatomite systems need only ¼ the housing space of equivalent-capacity sand plants. In fact diatomite systems are so compact, they can sometimes be added to existing plants.

If you're considering water filtration for the first time, it makes good financial sense to go Celite* diatomite all the way. An actual test installation by Johns-Manville has proved that a diatomite filter station can be installed for 45% less than a sand filter station of equal capacity.†

What's more, Celite will usually give better water clarity under comparable conditions. Turbidity is far lower. More suspended solids, including all floc, amoebae and algae, are removed. And a Celite diatomite system is easily operated and maintained by regular municipal water personnel.

Mined from the world's purest commercially available deposit, Celite is carefully processed for complete uniformity. Call your nearby Celite engineer for complete information on Celite's wide range of grades; he will gladly assist with your particular problems. And write today for FREE informative reprint.† Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

†Comparison Studies of Diatomite and Sand Filtration by G. R. Bell, Journal American Water Works Association, September, 1956.

JOHNS-MANVILLE JM PRODUCTS

# EQUIPMENT and MATERIALS FOR YOUR PUBLIC WORKS PROGRAM

## NEW LISTINGS

**The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.**

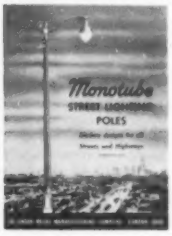
### F & E Constant-Flo Incinerator Stoker

**406.** Drawings, photographs and text describing the new design of this incinerator stoker for Constant-Flo operation are covered in Catalog No. 1703 from Flynn and Emrich Co., 301 Holliday St., Baltimore 2, Md. Check the reply card.

### Motor Graders With Torque Converter and Power Shift Transmission

**430.** Complete operation data and specifications of Huber-Warco motor graders are covered in Bulletin No. HWG521 available by checking the reply card or by writing Huber-Warco Co., Marion, Ohio.

### Street Lighting Poles for Streets and Highways




**443.** Standard designs, assembly details, suggested pole sizes, base construction details and bracket arm details are some of the details covered in this 22-page catalog. Check the reply card or write The Union Metal Mfg. Co., Canton, Ohio, for Catalog No. 78-A on street lighting poles of modern designs for all streets and highways.

### Dry Feeder Machines Catalog

**453.** Syntron "vibra-flow" dry feeder machines are designed for rate-controlled feeding of chemical reagents and dry bulk materials for water filtration and sewage disposal. Check the reply card or write Syntron Co., 660 Lexington Ave., Homer City, Pa., for complete descriptions and specifications.

### Rubber Tired Bituminous Paver Finisher

**460.** A rubber tired bituminous paver that can lay hot or cold asphaltic material in widths of 8 to 16 ft. and in depths of 0 to 10 ins. is described in bulletin from Blaw-Knox Co., Construction Equipment Div., Mattoon, Ill. Check the reply card.

### Electro-Matic PR System Solution to Traffic Signal Problems

**474.** Data is available on a PR system that is fully interconnected from sampling detectors to local intersection controllers by a choice of radio, 2-wire cable or standard telephone circuitry. Check the reply card or write Automatic Signal Div., Eastern Industries, Norwalk, Conn., for full details.

### Catalogs on Steel Shelving and Lockers

**475.** Steel shelving and lockers for public works departments are covered in literature from Penco Metal Products Div., Alan Wood Steel Co., Oaks, Penna. Check the reply card for sizes, models and uses.

### Liftainer Collection Units for Handling Trash and Waste

**483.** General specifications on portable steel containers and the Liftainer lifting and transporting units are covered in literature from The Cobey Corp., Galion, Ohio. Check the reply card.

### Chain Link Fence in 8 Basic Styles

**492.** Fence styles, line, end and corner posts, gates and the 4 fabric materials of fencing are covered in Bulletin DH-26 available from Page Fence Association, Monessen, Penna. Check the reply card.

**MORE LISTINGS ON PAGES 36 TO 49**

### Formulation for use in Thermal Snow and Ice Removal Systems

**493.** The properties and advantages of Dowtherm SR-1, a heat transfer fluid, and typical installation layouts are covered in catalog available from Organic Chemical Sales, The Dow Chemical Co., Midland, Mich., or by checking the reply card.

### Truck Tire Service Manual

**494.** This 46-page Manual gives complete data on ways and means to obtain more mileage from truck tires. Check the reply card or write Cooper Tire & Rubber Co., Findlay, Ohio, for your copy.

### Construction Materials Catalog for Highways, Streets and Sewers

**495.** Cold-applied and hot-poured joint sealing compounds, expansion joints, concrete curing compounds and preparation and application equipment are covered in 28-page catalog from Presstite-Keystone Co., Div. of American-Marietta Co., 39th & Chouteau Ave., St. Louis 10, Mo. Check the reply card.

### Buckets and Grapples for Incinerators

**500.** General purpose and materials handling buckets for use at incinerators and landfills are covered in literature from The Owen Bucket Co., Breakwater Ave., Cleveland 2, Ohio. Check the reply card for sizes and full details.

### Separation of Suspended Solids in Water and Sewage Treatment

**512.** A 24-page bulletin covering the complete line of clarifier and Oxidator® mechanisms is available from Process Engineers, Inc., 420 Peninsular Ave., San Mateo, Calif. Check the reply card for the basic types that cover a full range of tank sizes and load requirements, and special units for unusual conditions.

### Snap-on/off Backhoe for Rubber Tire and Crawler Tractors

**519.** Backhoe can be attached in half a minute to a tractor and can work at a variety of jobs. Literature available from the Badger Division of The Warner & Swasey Co., Winona, Minn., describes the machine fully. Check the reply card.

### Complete Manual on Smith Gate Valves

**533.** Normal range of sizes and pressures, the standard valve-end combinations available, the varying methods of operation, as well as valves for special services are some of the material covered in this manual. Check the reply card or write The A. P. Smith Mfg. Co., East Orange, N. J., for your copy.

### Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

**550.** Size and weight tables, minimum gages for live load strutted and unstrutted, layout details and plan developments are some of the material covered in this manual. Write American Bridge Div., United States Steel Corp., 525 William Penn Place, Pittsburgh, Pa., or check the reply card today.

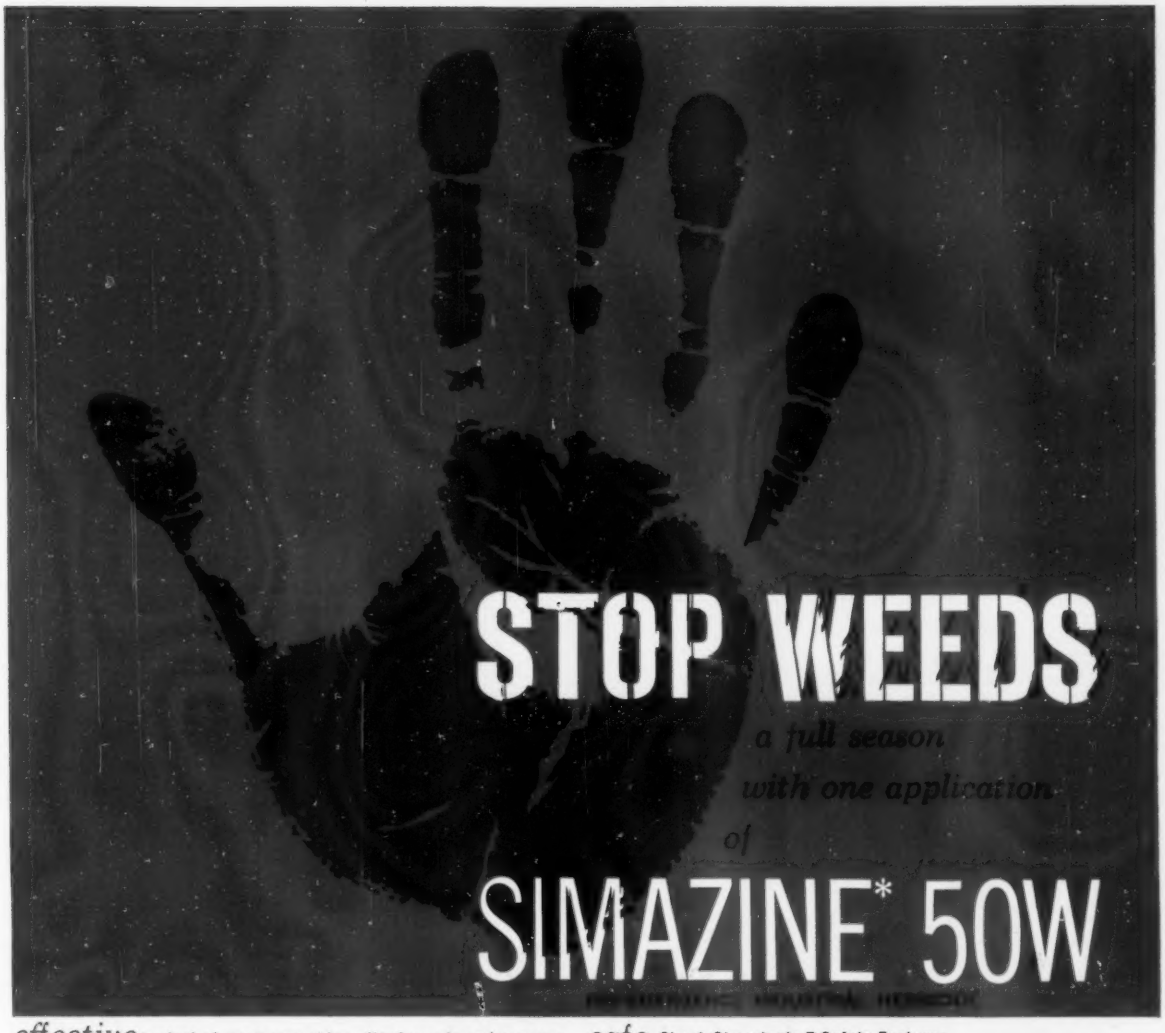
### 4-D Wrought Iron for Building Drainage Systems

**551.** A comprehensive 64-page catalog on piping for soil, waste, vent and downspout applications is available from A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa. Check the reply card for corrosive conditions, typical installation, performance tables and piping economy.

### Pedestrian, School and Directional Signals

**562.** Lightweight and easy to install pedestrian and directional signals are covered in literature from Safety Signal Div., Tru-Fit Screw Products Corp., 13000 Athens Ave., Cleveland 7, Ohio. Check the reply card for full specifications.

**Use the Reply Cards For Prompt Service**




*effective* control of most annual broadleaf weeds and grasses *safe* Check Simazine's 7 Safety Features

Preventive weed control with Simazine 50W saves time and labor — stops weeds and fires before they start.

At the rate of 20 lbs. per acre, one pre-emergence application of Simazine 50W controls most annual and many perennial broadleaf weeds and grasses for an entire season. For longer residual control, or for control of some of the more resistant perennials, use 30 to 40 lbs. per acre.

Geigy technical service is always available to help you. To obtain this service, name of nearest distributor or literature, address: Department 000.

*Check these Simazine 7 Safety Features*

1. SAFETY TO HUMANS AND ANIMALS
*Extremely low toxicity. No need for protective clothing.*
2. SAFETY TO ADJACENT VEGETATION
*Minimum lateral leaching. Remains where it is applied.*
3. SAFETY TO SPRAYING EQUIPMENT
*Non-corrosive or abrasive to equipment.*
4. SAFETY FROM ELECTRICITY
*Relatively low electrical conductivity.*
5. SAFETY FROM SOIL HAZARD
*Works through roots—little or no toxicity to foliage.*
6. SAFETY FROM FIRE HAZARD
*Non-flammable. No application hazard.*
7. SAFETY ON VALUABLE LAND
*Not a permanent soil sterilant.*

Geigy DESIGNATORS OF DDT INSECTICIDES
GEIGY AGRICULTURAL CHEMICALS

**To order these helpful booklets check the reply card opposite page 34.**

## NEW LISTINGS (Cont.)

### Filter Operating Control Desks

**521.** Specifications, designs, construction and operation of filter operating control desks are covered in literature from Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio. Check the reply card for your copy.

### Data on 4+ Cu. Yd. Motor Sweeper

**524.** Austin-Western, Construction Equipment Div., Aurora, Ill., has available a catalog on their Model 60 motor sweeper. Check the reply card for specifications, features and accessories.

### Aerial Lifts and Ladders and Self-Powered Diggers

**596.** Literature is available from the Truck Equipment Co., 3963 Walnut St., Denver 5, Colo., on aerial lifts and ladders that are used in street lighting and tree maintenance. Also covered are details on self-powered digger for guard-rail posts and poles. Check reply card.

### Coagulant Aids for Use in Municipal and Industrial Water Treatment

**574.** A 4-page bulletin describing Hagan coagulant aids points out how these aids speed up floc formation and also how they tend to produce larger and tougher flocs over wider pH ranges than coagulants alone. Check the reply card or write Hagan Chemicals & Controls, Inc., 323 Fourth Ave., Pittsburgh, Pa., for complete data.

### Dorr Clarifier for Rapid Sludge Removal

**577.** A 4-page, two color Bulletin No. 6193 entitled "The Dorr SR Clarifier" describes the design features and advantages of this new final unit for continuous, rapid sludge removal. Check the reply card or write Dorr-Oliver Inc., Havemeyer Lane, Stamford, Conn., for installation photos, line drawings of the unit and a chart of design data.

### Concreting of Airport Pavements and Structures

**587.** Catalog MBR-P-15 discusses problems encountered in concreting of airport pavements and structures and with photographs illustrates the importance of quality control and good concreting practice. Check the reply card or write The Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio, for your copy.

### Specifications on Trash-Sewage Pumps

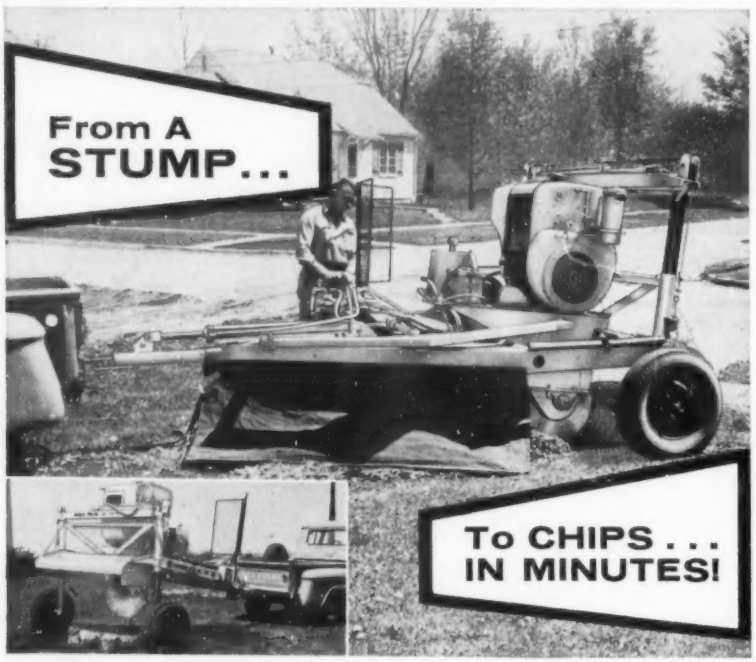
**599.** Complete specifications, drawings, performance curves and the applications of Gorman-Rupp trash-sewage pumps are covered in literature from The Gorman-Rupp Co., Mansfield, Ohio. Check the reply card.

### Streamlined and Modernized Fire Hydrants

**607.** Models, dimensions and advantages of the Eddy fire hydrant are covered in bulletin from the Eddy Valve Co., Waterford, N. Y. Check the reply card for complete details.

### Basic Fundamentals of High-Speed Earthmoving Techniques

**617.** This bulletin illustrates and explains the major factors in earthmoving equipment selection. Check the reply card or write the Advertising Division of Caterpillar Tractor Co., Peoria, Ill., for charts and performance characteristics.


# *Vermeer* POW-R-STUMP CUTTER

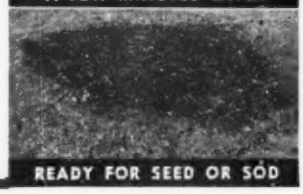
## Removes Stumps in Minutes—Not Hours!

Tree Service men and park, recreational and municipal officials all over the country are praising the Vermeer POW-R-STUMP CUTTER. More than an unusual new machine, the Vermeer POW-R-STUMP CUTTER is a revolutionary, new *principle*, that once and for ever has taken the cost, the time and the drudgery of labor out of stump-removal! "From a stump to chips . . . in minutes," is more than a by-word, too, it's a fabulous fact. The Vermeer POW-R-STUMP CUTTER removes the largest tree stump—rips it to shreds to a depth of ten inches below the surface of the ground—all in a matter of minutes. One man, only, is required for the whole operation. And when the job is done there's no stump left to be hauled away, no gaping hole to be filled, no rutted lawns, no damaged curbs, driveways or sidewalks.

**This is just part of the remarkable story about the Vermeer POW-R-STUMP CUTTER. To get all the details, write—today—for the colorful new FREE folder, just off the press.**

AN UNSIGHTLY STUMP

A FEW MINUTES LATER


READY FOR SEED OR SOD

*THE ORIGINAL STUMP CUTTER*
*FIRST & FINEST IN THE FIELD*

**VERMEER MFG. CO.**
**1439 W. Washington Pella, Iowa**


## *Use The Reply Card*

### AWWA Butterfly Valves Custom Built to Specifications

**630.** Butterfly valves that can be operated by air, oil, water, electrically or manually and are made in standard sizes to 24 ins. are fully described in literature from Fabri-Valve Co. of America, P. O. Box 4352, Portland 8, Ore. Check the reply card for full specifications.

### 59 Ideas for Modernization in '59

**639.** Modernizing can start anywhere and it is the purpose of this catalog to point out the many ways that public works departments are finding to modernize or update their operations. Copies are available from Allis-Chalmers Mfg. Co., Industrial News Bureau, Publs. & Ind. Press Dept., Milwaukee 1, Wis., or by checking the reply card.

### Control Weeds and Brush Along Highways

**640.** Literature from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, describes how use of weed and brush killers help reduce accidents and also included is a handy, ready-reference control chart that covers weed control problems, quantity of solution to use and economical application. Check the reply card.

### Sweeping Brushes for Road and Sanitation Departments

**648.** Danline brushes made of round brush wire are easily assembled and require a minimum amount of repair and maintenance. Check the reply card or write Newark Brush Co., 260 Michigan Ave., Kenilworth, N. J., for full details.

### Portable Water Coolers Used on Maintenance and Construction Work

**651.** Igloo cans and coolers are permalined and range in capacity from 2 to 15 gals. Models and sizes are covered in bulletin available from Igloo Corp., P. O. Box 8227, Memphis 4, Tenn., or by checking the reply card.

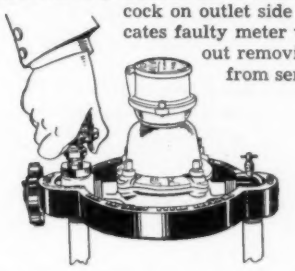
### Mueller Drilling, Tapping and Inserting Machine

**696.** The Mueller B-100 double pressure chamber tapping machine makes faster taps, assures pressure tight connections and can be used by hand or with power. Check the reply card or write Mueller Co., Decatur, Ill.

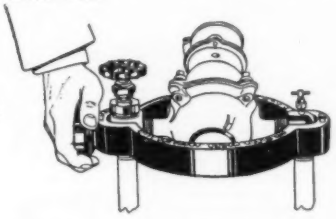
# Meter Installation And Removal Now Simplified

With the use of Clark Meter Yokes, installation or removal of meter is a simple job requiring only a few seconds' time. Only one hand is needed, assuring ample visibility in the box.

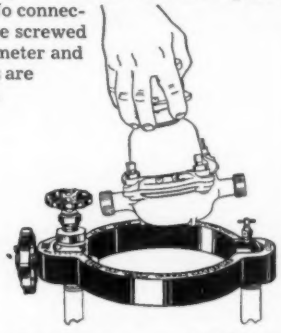
***Closing Valve.*** A few easy turns close the water-way without use of tools. Try-cock on outlet side indicates faulty meter without removing it from service.



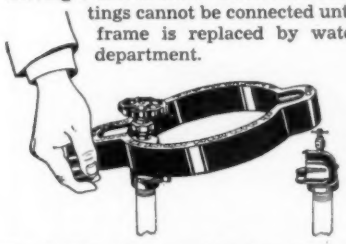
***Releasing Meter*** is accomplished with a few turns of handwheel. Meter tips and rests on yoke frame. It cannot fall over frame and drop to bottom of meter box.



***Removing Meter.*** Just lift out. Gaskets stay in position and need no replacement. No connections are screwed on the meter and no tools are needed.

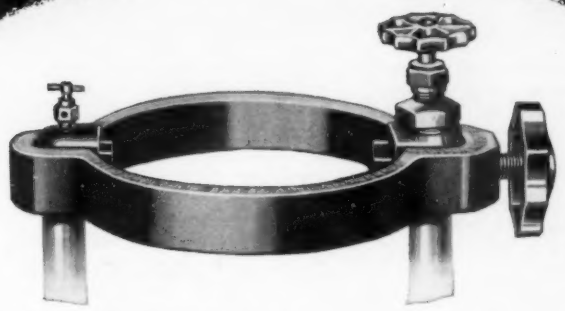


***Sealing Service*** is accomplished by removing frame of Clark Meter Yoke. Fittings cannot be connected until frame is replaced by water department.



For further details and features of these time-saving meter yokes, we suggest that you write the manufacturer, H. W. Clark Co., Mattoon, Illinois . . . mentioning this article and publication.


# CLARK METER YOKES
## For Easy One-Hand Operation



No. 4 CLARK METER YOKE. Installation is made without bolts, rivets or screws. Outlet try-cock ell determines condition of meter and inlet control valve ell facilitates easy exchange of meters.

Try-cock Ell



Valve Ell

Bronze Ell and Valve with Copper Connections.

SPACER CLAMP ties riser pipes together rigidly at bottom of meter box and automatically liberates meter when handwheel is loosened.

Thanks to simplified design and construction, Clark Meter Yokes permit easy one-hand operation. They are manufactured in a minimum number of sizes to meet every requirement of simplified operation. Because they eliminate so many parts, Clark Meter Yokes are also economical. Costs of meter couplings, curb stop, service box and several pipe fittings are saved. Circular one-piece cast iron frames give added strength, and these yokes are quickly installed on any type of service line. Available for either iron or copper pipe. To get all the details . . .

***Write for New Catalog***

**H. W. CLARK CO.**

MATTOON, ILLINOIS

## To order these helpful booklets check the reply card opposite page 34.

## NEW LISTINGS (Cont.)

### Complete Data on Cleveland Trenchers

**693.** V-conveyor, automatic conveyor shift, dual independent conveyor drive, hydraulic steering brakes and hydraulic crumbling shoe are some of the features of the new Cleveland trenchers. Check the reply card or write The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio, or check the reply card for data on models and specifications.

### Data on Portable and Stationary Air Compressors and Accessories

**652.** Covered in literature available from Gordon Smith & Co., Inc., Bowling Green, Ky., are the basic designs of portable air compressors, models, operating features and specifications. Check the reply card.

### A Different Form of Pneumatic Instrumentation

**658.** The "C.-A.-P. System" instruments use controlled air pressure in the 0.25 to 3.25 psi range to operate an air motor for positioning valves, regulating chemical feed rates and indicating and recording measurements of flow, level or pressure. For Bulletin 1100-B describing this system, write Infileo Inc., P. O. Box 5033, Tucson, Arizona, or check the reply card.

### Plug Valve Lubricant Catalog

**659.** A 16-page illustrated catalog gives lubricant recommendations for nearly 4000 service conditions for which lubricated plug valves can be used. It also shows lubricated plug valve accessories, fittings and lubricant guns. Write Homestead Valve Mfg. Co., Coraopolis, Pa., or check the reply card.

### Manual on Highway Railings For Bridges and Roadways

**660.** This manual covers design suggestions, components, specifications for design and construction and the advantages of Alcoa aluminum alloy highway railings. Check the reply card or write Aluminum Company of America, Alcoa Bldg., Pittsburgh 19, Pa., for this valuable manual.

### Dowpac Applications In Waste Treatment

**663.** A 32-page bulletin about Dowpac, new plastic trickling filter media contains illustrated information on the product's physical properties, assembly instructions and operational characteristics, including performance data gathered from pilot plant installations. Copies are available from Plastics Merchandising Dept., The Dow Chemical Co., Midland, Mich., or by checking the reply card.

### Expansion Joints Used In Concrete Construction

**680.** Asphalt, fibre, corkfill and sponge rubber expansion joints are covered in catalog on Sealtight joints and other top-quality Sealtight products available from W. R. Meadows, Inc., 25 Kimball St., Elgin, Ill. Check the reply card for data on how these expansion joints are used in pavements, runways, bridges, ramps and other concrete structures.

### Full Line of Sewer Cleaning Equipment

**681.** Everything for rodding sewers from hand operated equipment to the fully mechanized SeweRodeR. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif.

### How Good Are Your Truck Drivers? The Tachograph Will Tell You

**682.** Accurate records of truck engine operation are made available by the Tachograph. Find out how savings and safety can be promoted by getting Bulletin SU-3 from Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo. Details of construction and descriptions of operation are included. Check the reply card today.

### Cast Iron Pipe That Bends Under Stress

**683.** This cast iron pipe from 2 through 48 ins. has as advantages extra strength, high resistance to impact, bendability, greater reliability, ample wall thickness and adaptability. Check the reply card or write American Cast Iron Pipe Co., Birmingham, Ala., for full specifications.

### Copymaker for Every Office, Business and Department

**686.** Catalog available from American Photocopy Equipment Co., 2100 West Dempster St., Evanston, Ill., is well illustrated and points out the applications and advantages of copy machines for every business.

### Reliable, Twist-Lock Photoelectric Control for Street Lighting

**687.** Photoelectric control fits GE mercury Power Pack and mercury or filament hoods and guards against damage from induced voltage surges and eliminates added cost of external secondary arrestor. Check the reply card or write General Electric Co., Schenectady 5, N.Y., for full details.

### Bulletin Covers Step-by-Step Action on the Water Problem

**689.** A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois, or by circling the reply card.

### Transit Cranes for Bridge and Highway Building

**691.** Transit cranes that can lift 33,000 lbs. at 20-ft. radius, and 13,000 lbs. at 40-ft. radius with 60-ft. boom and outriggers set are described in literature from Bucyrus-Erie Co., South Milwaukee, Wisconsin. Also featured are load control, folding boom and boom lengths.

### Water Filtration Costs Can Be Reduced

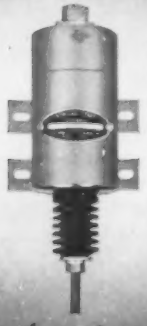
**692.** The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N.Y.


*Continuous Duty*

**D.C. SOLENOIDS**

*with* **A N CONNECTOR**

*Synchro-Start* MODEL SD-A SOLENOID has an exceptional amount of power over a long stroke with a standard A N Connector. The sealed casing protects this solenoid from seepage of dust and liquids. This solenoid is also available with standard terminal studs instead of the A N Connector (Model SD).



*Specifications*—SD-A can be furnished in all standard and special voltages up to 115 Volts D.C.

10 lb. pull over 1½ inch stroke.

Power consumption, 550 Watts pulling and 8 Watts holding.

Housing dimensions, 4⅛"x2½".

*Further information upon request.*

SYNCHRO-START PRODUCTS
INCORPORATED
8151 N. RIDGEWAY AVE. • SKOKIE, ILL.



**TRENCHES**

**2⅛" to 8" wide • Depths to 6'**
**Self-Propelled•Hydraulic Drive**
**Low Cost • Pays for Itself!**

The economic Arps Model M Trench-Devil will handle most of your trenching jobs faster, easier and at lowest cost per foot of trench. For the largest percentage of ditching work — foundations, water services, underground wiring, gas lines, sprinkler systems — this heavy duty, one-man outfit will outdig larger units costing many times its low price. Get more information *now* on this and other famous Arps Trenchers for larger and smaller jobs. The Arps Corporation, New Holstein, Wis. Dept. PW

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TRENCHERS
HALF-TRACKS • BULLDOZERS
UTILITY BLADES

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*. . . longer tool life*

*. . . perfect connections*

**Rigidity on the main . . .**

Widely spread chain hook washers of the new B-100 are deeply recessed in yoke—cannot slip off when used on large diameter pipe. Unique design of chain hook keeps chain from twisting while tightening. They all add up to absolute rigidity on the main—machine cannot move during drilling, tapping or inserting operations. Broken tools and leaky connections are eliminated.

**Rigidity in the boring bar . . .**

Three widely spaced boring bar bearings, two in the feed sleeve and one at extreme bottom of boring bar, assure perfect boring bar alignment. Molded nylon lower bearing supports drill when it first contacts the main. Pipe curvature cannot deflect drill—tools give longer effective life. These three boring bar bearings guarantee perfect centering of tool and stop, assuring a pressure-tight connection.

*These are only a few of the many advanced features of the new Mueller B-100 Drilling, Tapping and Inserting Machine. They are typical, however, of the attention to detail in research, design and engineering that become a part of every Mueller product used by the water industry.*

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**B-100 Machine**

**MUELLER CO.**
**DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

**To order these helpful booklets check the reply card opposite page 34.**

TWO PIECE
sliding or screw type cast iron valve boxes for covering 4" thru 10" valves for water or gas. Rugged construction for lifetime service. 5¼" shaft. Extensions as required.
Adjustable
VALVE BOXES
THREE PIECE
valve boxes supplied with separate bases are available in sliding or screw type. Made with 5¼" and 7" shafts with extensions as required. Complete line of service and roadway boxes.
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Furnished with compression bell for wet well. Pressure differential regulator with meter that regulates and indicates rate of air flow. Furnished with air compressor, or can be operated from plant air supply.
Write for New Bulletin RPS
WATER LEVEL CONTROLS DIVISION
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## WATER WORKS

### In-Place Cement Lining of Small and Large Pipe

**25.** A catalog describing a process of in-place centrifugal cement lining of pipes from 4 to 144 ins. in diameter is available from the Centriline Corp., Raymond International Inc., 140 Cedar St., New York 6, N. Y. Check the reply card for sample specifications and test results.

### Elevated Tanks and Other Storage Facilities

**32.** Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

### Ball and Socket River Crossing Cast Iron Pipe

**33.** Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

### Plastic Wash Troughs For Water Treatment

**45.** Leopold fiberglass-reinforced plastic wash troughs for water treatment are described in literature from F. B. Leopold Co., Zelienople, Pa. Check the reply card for data on these units that will last for years without any painting or other maintenance.

### Handbook of Cast Iron Pipes and Fittings

**52.** Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

### How Eleven Cities Installed Water Meters

**56.** This 8-page bulletin describes the planning and operational procedures used by 11 water departments and companies in the installation of about 200,000 water meters. Check the reply card or write The Ford Meter Box Company, Inc., Wabash, Ind., for methods of installation and rate cards.

### Catalog on Synchronous Motors and Controls

**64.** A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

### Efficient Coagulation With Ferri-Floc

**69.** Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

### Rapid Sand and Pressure Filter Data

**109.** Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

### AWWA Fire Hydrants and Gate Valves

**155.** Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

### Fischer & Porter Quick Shipment Catalog and Price List

**72.** A 52-page catalog on process instruments which covers indicators, transmitters, recorders and controllers for flow, pressure, temperature, density, viscosity and consistency is available from Fischer & Porter Co., 941 Jacksonville Road, Hatboro, Pa., or by checking the reply card.

### Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

**76.** An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

### Valve and Hydrant Construction Details

**161.** A 72-page catalog-type bulletin, just completed, gives detailed data on construction and application of gate valves, check valves and hydrants for water works service. Write for Bulletin 5710 from Darling Valve and Mfg. Co., Williamsport, Pa., or check the reply card.

### Submersible Electric Pumps For Dewatering Problems

**167.** Pumps range in size from 1½"-85 gpm capacity to 8"-300 gpm capacity, with head capacities up to 210 ft. Write to Stanco Mfg. & Sales Inc., 1666 Ninth St. (Corner of Olympic & Ninth), Santa Monica, Calif.

### Now Every Municipality Can Own a Trencher

**173.** The low cost of the ARPS Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

### Complete Catalog and Reference Data on Valves and Fittings

**211.** The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

### Manual on Pipe Finding Techniques

**213.** A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

### Catalog on Dewatering Pumps

**226.** Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP7 from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

### Outline of Modern Water Treatment Equipment

**248.** Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

### Waterworks and Municipal Castings

**293.** Meter boxes and covers, yokes and couplings, service boxes and manhole covers are covered in 24-page catalog. Check the reply card or write H. W. Clark Co., Mattoon, Ill., for full specifications.

## Ready-Mix plant owner says

# "I Looked at Other Loaders . . . but I Liked Tractomotive best"

When it comes to buying equipment, careful consideration is given to its purchase by E. C. Voit & Sons, Inc., owner of a Ready-Mix concrete plant in Madison, Wis.

"I looked at other loaders," said Mr. Voit, "but I liked this 2-yd TL-20 TRACTOLOADER* best." He added that he also likes the Tractomotive dealer — "our relations have been mighty happy over the years."

A good product backed by a good dealer — that's the combination Tractomotive offers you—no matter where you are located. Allis-Chalmers construction machinery dealers throughout the world handle Tractomotive loaders and other Tractomotive products exclusively.

Like Mr. Voit, why not see what a modern TRACTOLOADER will do before *you* decide. On the TL-20 and TL-16, the exclusive *one-lever* control of speed and direction alone will add many extra yards to your daily production. See your nearby Allis-Chalmers dealer soon . . . he has a full line of TRACTOLOADERS to show you — two- and four-wheel drive.

*TRACTOLOADER is a registered Tractomotive trademark.

*ALL TRACTOMOTIVE EQUIPMENT IS SOLD AND SERVICED BY YOUR ALLIS-CHALMERS DEALER*

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a sure sign
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## To order these helpful booklets check the reply card opposite page 34.

### Technical Bulletin on Swimming Pool Filtration Equipment

**335.** A 24-page technical Bulletin 626, designed to help persons planning pools which must comply with local and state health regulations, is now available from the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Check the reply card for data on size selection charts, typical installations and drawings.

### U. S. Tyton Joint Pipe

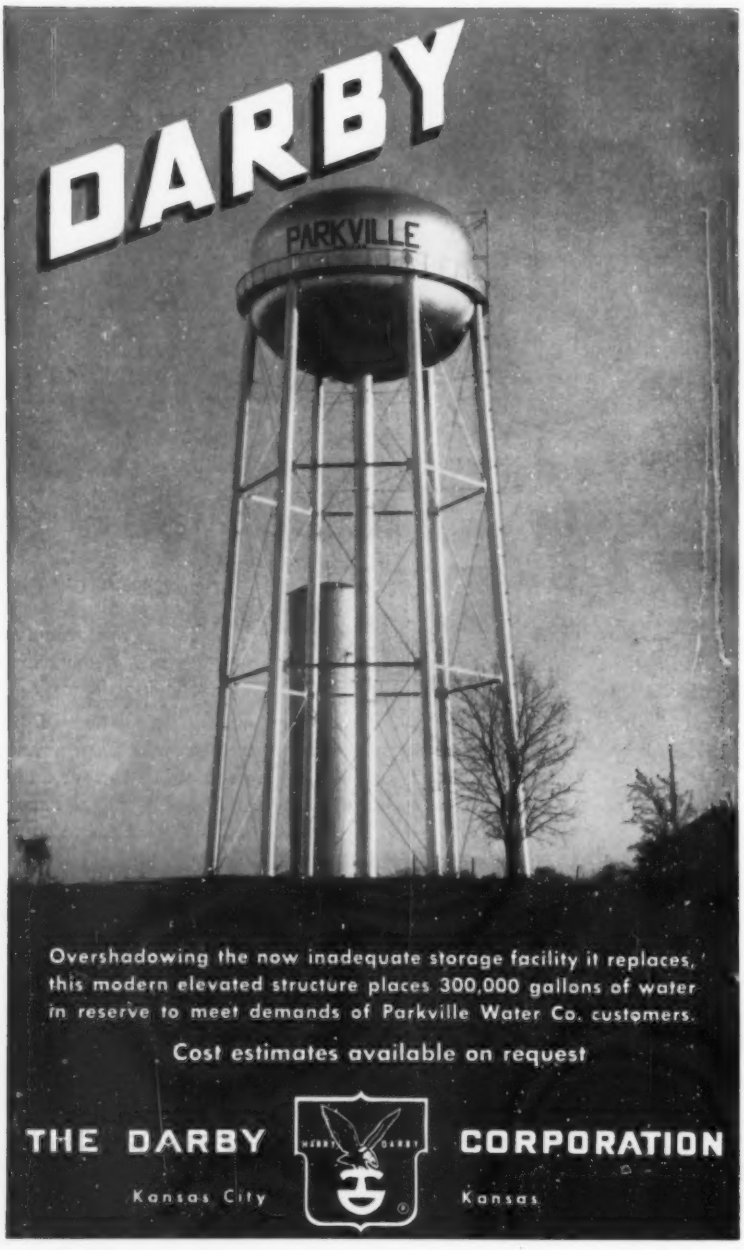
**490.** An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co. Birmingham 2, Ala., or check the reply card.

### Copper Sulfate In Control of Microscopic Organisms

**529.** This valuable 52-page manual on the use of copper sulfate in the control of microscopic organisms in water supplies is available from Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y. Covered are organisms, odors, methods of using copper sulfate, calculation tables and table showing chemicals required for treatment of different Genera.

### Badger Read-o-Matic Register For Outside Water Meter Reading

**536.** The Read-o-Matic is simple to install and requires no outside power. Doorbell-type wire carries the pulse from generator in meter to the register on the outside of the building. Check the reply card or write Badger Water Meters, 4545 West Brown Deer Road, Milwaukee 18, Wisc.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PARKVILLE
Overshadowing the now inadequate storage facility it replaces, this modern elevated structure places 300,000 gallons of water in reserve to meet demands of Parkville Water Co. customers.
Cost estimates available on request
THE DARBY CORPORATION
Kansas City
Kansas


### Morton Purex Salt For Water Plants

**324.** Sludge-free Morton Purex salt is described in literature from Morton Salt Co., Industrial Div., Dept. PW, 110 N. Wacker Drive, Chicago 6, Ill. Check the reply card for information on this 100 percent soluble salt.

### Manual on the Hersey Disc Water Meter

**329.** Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-¾"x¾"-¾" and 1". Check the reply card.

### How Your Filter Washing Can Be Improved

**368.** More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Check the reply card.

### Helpful Engineering Data on Cast Iron Pipe

**422.** Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

### V-Notch Chlorinator For Chlorine Flow Control

**502.** An 8-page catalog on the W & T Series A-721 chlorinator is available from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Chlorinator is adaptable to any type of chlorinator control and feed rate may be controlled manually or automatically.

### Modern Elevated Water Tanks

**566.** A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheroid, is available from the Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered.

### Water Service Hydrants and Outdoor Drinking Fountains

**661.** Water service hydrants in 4 sizes, ¾", 1", 1¼" and 2" and all types of outdoor drinking fountains are described in a well-illustrated, 24-page catalog from The Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati 2, O.

### Electronic Locators for Water Mains, Services, Valves and Boxes

**677.** Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours is described in literature from Wilkinson Products Co., 3987 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

### Flexible Plastic Pipe For Water Distribution

**708.** A new-type polyethylene resin flexible pipe is described in Catalog No. 402 available from Orangeburg Mfg. Co., Inc., 375 Park Ave., New York 22, N. Y. Fittings, installation, size and weight tables and physical properties are several of the sections covered.

### Ball Joint Pipe For River Crossings

**746.** A well illustrated 32-page catalog containing instructions for assembly, weights and dimensions, and different methods of installing Molox ball joint pipe for river crossings and submarine service is available from American Cast Iron Pipe Co., P. O. Box 2603, Birmingham 2, Alabama. Check the reply card.

### Calgon TG For Better Corrosion Control in Water Systems

**780.** Calgon Composition TG is a sodium-zinc hexametaphosphate corrosion inhibitor for municipal water systems. Bulletin 420-12-9 is available from Calgon Co., Hagan Chemicals & Controls, Inc., Hagan Bldg., Pittsburgh 30, Pa., or by checking the reply card.



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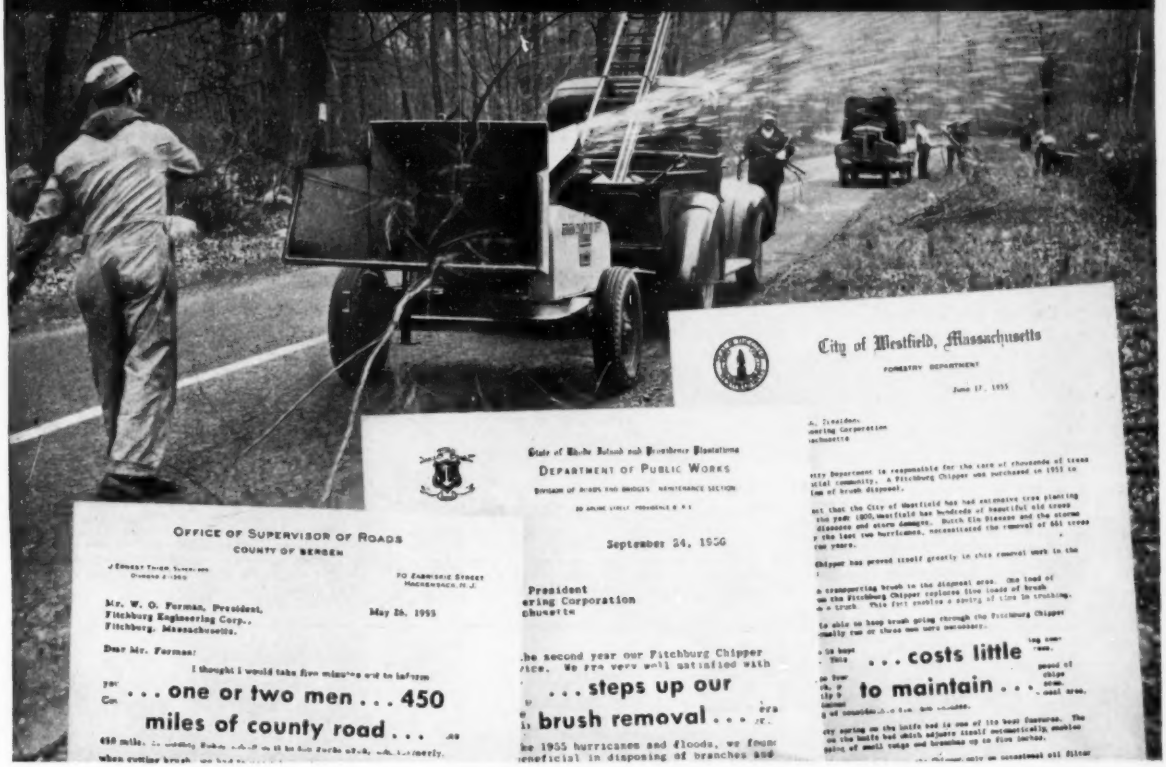
# Is a FITCHBURG CHIPPER your answer to speedy, economical brush removal?


City of Westfield, Massachusetts
FORESTRY DEPARTMENT
OFFICE OF SUPERVISOR OF ROADS
COUNTY OF BERGEN
May 25, 1955
Mr. W. O. Forman, President,
Fitchburg Engineering Corp.,
Fitchburg, Massachusetts.
Dear Mr. Forman:
. . . one or two men . . . 450
miles of county road . . .
DEPARTMENT OF PUBLIC WORKS
September 24, 1956
President
. . . steps up our
brush removal . . .
. . . costs little
to maintain . . .

A City, a County, a State have found the Fitchburg Wood Chipper to be their answer to difficult brush removal. These short quotations from out of many testimonial letters show how quickly Fitchburg can solve a difficult municipal expense—brush removal.

*City of Westfield, Massachusetts:*
*"costs little to maintain."*

*Bergen County, New Jersey:*
*"one or two men . . . for 450 miles of County Road."*

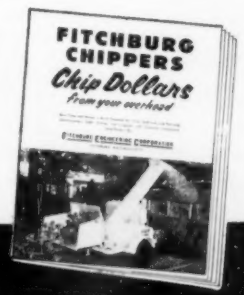
*State of Rhode Island:*
*"steps up our brush removal."*

Your City, County, and State, too, can discover these advantages when your maintenance crews use Fitchburg Chippers. Brush crews like the safety of the patented safety spring-activated feed plate—a Fitchburg exclusive—that adjusts itself automatically when brush is fed into the Chipper. They use the disc-clutch that gives Fitchburg a fast stop-start for added safety. Park crews find that Fitchburg's low maintenance, normal lubrication, and tough, chrome steel knives hold their keen edges to keep their chippers working . . . fast!

Look to Fitchburg when you need brush chippers. Check Fitchburg's One Year Guarantee . . . Fitchburg's overall specifications. See the safety features . . . the rugged construction built for long, hard-working service. Your city, county, and state maintenance crews will speed up their brush removal. Make a Fitchburg Wood Chipper your answer to difficult brush removal.

**NEW FREE BOOK**

"Chip Dollars From Your Overhead." 20 pages. Complete with cutaway color drawings of Fitchburg Chipper in action. Specifications, etc. Write for your copy. Address Dept. PW-29.




**FITCHBURG ENGINEERING CORPORATION**
FITCHBURG, MASSACHUSETTS

**To order these helpful booklets check the reply card opposite page 34.**

## SEWERAGE AND WASTE TREATMENT

### What You Should Know About Trickling Filter Underdrains

**20.** Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N.J. Check the reply card and we will forward your request.

### Equipment For Water, Sewage and Industrial Waste Treatment

**34.** The complete line of Jeffrey equipment for treatment plants is covered in a 66-page Catalog 905 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and scum removers to mention some of the equipment.

### Stationary Engines For Sewage and Water Treatment Plants

**82.** Engines that operate on sewage gas, gasoline, butane or natural gas are described in literature from Climax Engine Mfg. Co., Div. of Waukesha Motor Co., Clinton, Iowa. Check the reply card.

### Automatic Engine Control Equipment Manual

**83.** This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

### Right Angle Gear Drive For Centrifugal Pumps

**107.** Applications, gear drive selection tables, pulley data, efficiencies and standard dimensions of Johnson right angle gear drives are covered in catalog from Johnson Gear & Mfg. Co., Ltd., Eighth and Parker Sts., Berkeley 10, Calif. Check the reply card.

### Manual on Coatings to Stop Rust

**235.** Primer type, short oil type, heat resistant, chemical resistant and floor coatings are a few of the items covered. Also complete data on Rust-Oleum products are included. Check the reply card or write Rust-Oleum Corp., Evanston, Ill., for this valuable manual.

### Data Offered on Water, Sewage and Waste Treatment Equipment

**263.** Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described.

### How to Dispose of Sewage and Industrial Sludges

**281.** Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1315 No. Branch St., Chicago, Illinois.

### Small Unit Sewage Treatment For 20 to 5000 People

**568.** Bulletin 135 describes the Rated-Aeration process, a low cost, odorless, trouble-free sewage treatment process. Check the reply card or write Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill.

### Complete Story of Rubber as a Coupling Medium in Pipelines

**295.** "Joint Enterprise", a booklet describing Tylox rubber joints for coupling pipe used in sewerage, drainage and waterworks projects is now available from Hamilton Kent Manufacturing Co., 7 West Grant St., Kent, Ohio. The booklet also contains illustrated case histories of Tylox-Jointed installations, and suggestions to assist engineer in specifying Tylox joints for both tongue and groove, and bell and spigot pipe. Check the reply card.

### Pneumatic Sewage Ejector Pumping Systems for Low Flows

**317.** Dimension and capacity tables for pneumatic float or electrode controlled ejectors, cast iron or welded steel, covering flow ranges of 20 to 600 gpm, including all information necessary in design are given in Bulletin No. KSM-2 3/58. Check the reply card or write Komline-Sanderson Engineering Corp., 101 Holland Avenue, Peapack, N. J.

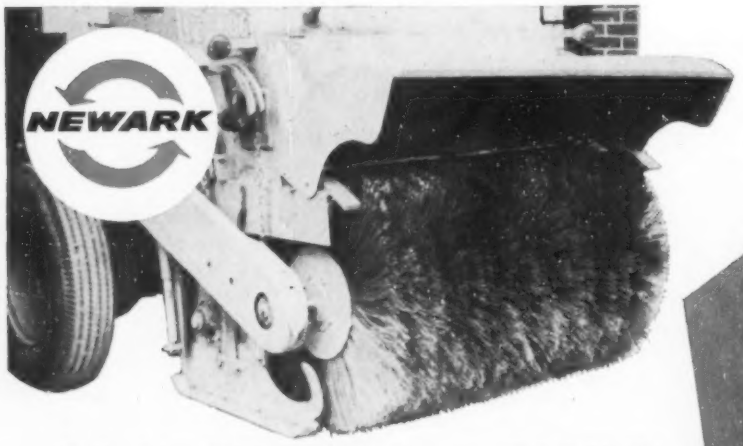
**For Prompt Service Use The Reply Card**

### Engineering Data on Gas Safety Equipment

**343.** P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

### Diesel Engines For Municipal Power Needs

**359.** Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif.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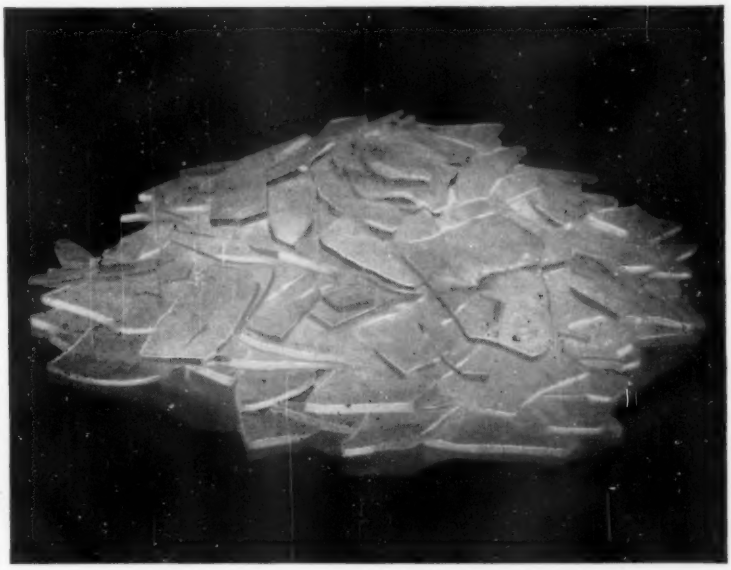

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## To order these helpful booklets check the reply card opposite page 34.

### Blower Selection Data Aids Sewage Plant Design

**144.** Characteristic curves for blower operation with constant-speed, multi-speed and variable speed motors; details of several types of blowers; data on accessories; and a discussion of advantages of positive displacement rotary blowers are provided in Bulletin RB 154 of Roots-Connersville Blower Div., Connersville, Ind.

### Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

**425.** Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

### Manual on Solving Drainage Problems

**554.** A 74-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for this valuable book.

### Controls For Use in Pumping Stations and Sewage Plants

**662.** Single and multi-pump sump controls, pressure operated for use in pumping stations and sewage disposal plants are described in literature available from Healy-Ruff Co., Water Level Controls Div., 2255 University Ave., St. Paul 14, Minn. The two principal types of pressure operated sump controls are covered along with general descriptions and features.

### Water, Waste and Sewage Treatment Equipment

**546.** Covered in this 24-page catalog are bar screens, thickeners, collectors, aerators, gas holders, floating covers and mixers. Check the reply card or write Walker Process Equipment Inc., Aurora, Ill., for complete details on trickling filters, sludge removal and digestion, industrial waste and recovery.

### Handbook on Selecting Power For Pumping

**694.** A 12-page power selection handbook, "Selecting Power For Pumping," has been released by the Advertising Div., Caterpillar Tractor Co., Peoria, Ill. This handbook is especially useful to those who have a pumping operation. It contains a checklist of features necessary for continued dependable operation on pumping jobs. List describes the proper requirements which an engine must have, backing them with illustrations and examples of efficient installations. Check the reply card today.

### Reinforced Concrete Pipe For Culverts and Sewers

**672.** Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

*Use The Reply Card*

### Simplify and Save on Public Works Electrical Construction

**710.** Information and literature is available from Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa., on how you can simplify electrical details of a public works project. Westinghouse field specialists will help you plan the electrical system to fit your need. Check the reply card.

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Copper Sulfate
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Not only is Triangle Brand Copper Sulfate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
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## REFUSE COLLECTION AND DISPOSAL

### Reduce Your Refuse Disposal Costs

**150.** A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Dempster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.

### Refuse and Garbage Packer Bodies

**241.** Ranging in capacity from 12 to 24 cu. yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

### How to Construct A Sanitary Fill

**331.** A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

### Data on the Hydro E-Z Pack Disposal Body

**572.** This disposal body has no moving chains, no whirling knives, and has a 76,600 lb. pressure that takes anything and compacts everything. Check the reply card or write Hydro E-Z Pack, Div. of Hercules Galion Products, Inc., Galion, Ohio, for a copy of Bulletin E-100.

## STREETS AND HIGHWAYS

**Useful Attachments for "Payloader" Tractor Shovels**

**95.** Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

**Rugged Axles Save Money For Truck Owners**

**151.** Eaton axles feature planetary gearing, self-contained air brake, positive shift control, inductalloy axle shafts and forced-flow lubrication. Check the reply card or write Axle Div., Eaton Mfg. Co., Cleveland, Ohio, for complete catalog.

**Non-Electric Traffic Control Products**

**156.** Reflective pavement marking glass beads, Cataflex "202" reflective coating, Cataline reflective striping, Catatherm reflective plastic striping, plain and reflective street and highway signs, plain and reflective street name signs are covered in literature from Cataphote, Corp., P. O. Box 2066, Jackson, Miss.

**Chip Dollars from Your Overhead With Fitchburg Chippers**

**160.** Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. PW, Fitchburg, Mass.

**Rubber Roads Are Now a Reality**

**230.** Ramflex, a free-flowing, devulcanized rubber specially prepared to be used in combination with asphalt for highway paving applications is described in illustrated catalog from U. S. Rubber Reclaiming Co., Inc., P. O. Box 365, Buffalo 5, N. Y. Check the reply card.

**Manual on the Use of Calcium Chloride**

**301.** This manual presents the physical and chemical properties of the new pellet-type calcium chloride and its water solutions. Also, gives complete data on shipment, handling and storage. Check the reply card or write The Dow Chemical Co., Midland, Mich., for your copy.

**From a Stump to Chips in Minutes**

**303.** Pow-R-Stump cutter is operated by one man, handles stumps of any width and up to 33 ins. in height and will not damage curbs, driveways or sidewalks. For literature check the reply card or write Vermeer Mfg. Co., Pella, Ia.

**Manual on Gray Iron Castings For Highways and Municipalities**

**309.** Construction castings covered include catch basins, catch basin inlets and covers, manhole frames and covers and cast iron manhole steps. Check the reply card or write Brillion Iron Works, Inc., Brillion, Wisc., for your copy.

**Information on Boring Machines**

**365.** General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

**Manual on All Types of Traffic Signs**

**379.** This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans., for your copy.


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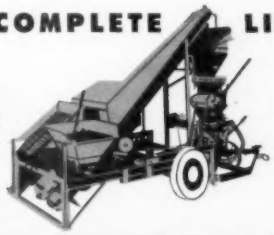

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**To order these helpful booklets check the reply card opposite page 34.**

### Ultra-Clean Sweeping For Streets, Yards and Airports

**499.** A new approach to extra-clean sweeping is described in a 4-page illustrated Bulletin (No. 85.55) issued by the G. H. Tennant Co., 755 N. Lilac Drive, Minneapolis 22, Minn. Described is a 7'4" path sweeper that eliminates the use of water for dust control. Check the reply card.

### Light Duty Trucks For Construction and Maintenance

**628.** Pickup and stake body trucks are fully described in literature from Ford Div., of Ford Motor Co., Dearborn, Mich. Pickups are available in 6½, 8 and 9-ft. lengths. They come in standard colors and with either a 6 or V-8 engine. Rigid tailgate and steel corner posts add to the over-all body strength. The stake body trucks come in 6½, 7½ and 9-ft lengths. These units also come in 6 or V-8 engines. Check the reply card for full information.

### Pre-Assembled Dowel Units For Highway and Airport Construction

**537.** Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

### Sweepers Handle A Variety of Jobs In Every Season

**684.** Mechanical drive one-way and pull type 2-way sweepers and hydraulic 2-way sweepers that are tractor-mounted or loader-mounted are fully covered in literature from M-B Corp., 1611 Wisconsin Ave., New Holstein, Wisc. Jobs like cleaning dust, dirt and snow from streets and highways and sweeping park lawns are a few of the sweepers applications. Check the reply card.

### Cushman Truckster Hauls an 800 lb. Payload

**392.** Complete information on the Cushman Truckster is available from Cushman Motors, 1005 No. 21st., Lincoln, Nebr. Features are constant mesh transmission, hydraulic brakes, 12-volt lighting system, etc.

### A Guide to Effective Traffic Safety

**468.** A 20-page catalog with hundreds of illustrations of all types of signs used on highways and in motor and pedestrian traffic areas is offered to public works officials by Traffic and Street Sign Co., 84 Foundry St., Newark 5, N.J. This convenient reference covers all your sign needs.

### IHC Crawler Tractors For Highway Construction

**491.** Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

### Literature on Reflective Glass Beads

**690.** Glass beads for traffic signs and street name signs are described in literature available from Flex-O-Lite Mfg. Corp., 8305 Flex-O-Lite Drive, P. O. Box 3066 (Affton Br.), St. Louis 23, Mo. Beads can be used on white and yellow signs. Check the reply card.

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## BUSINESS ADMINISTRATION

### Stabilene Film for Drafting, Scribing and Reproduction

**60.** Stabilene film insures accuracy of drawing and reproduction and will last indefinitely. It comes in rolls, sheets or special sizes to order and lies flat or can be curved or rolled. Check the reply card or write Keuffel & Esser Co., Adams and Third Streets, Hoboken, N. J., for complete catalog.

### System For Duplicating and Filing Engineering Drawings

**754.** The Recordak system for comprehensive filing of engineering drawings is described in literature available from Recordak Corp., 415 Madison Ave., New York 17, N.Y. Drawings are first microfilmed and then they are added to an aperture card for indexing.

•

## RECREATION

### How to Equip Your Parks and Playgrounds

**414.** A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, park picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.

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## WEED AND DUST CONTROL

### Weeds Controlled by Using Simazine 50W

**278.** General weed control is accomplished by using Simazine 50W and water. For full information on this new pre-emergence herbicide and how to use it write Geigy Agricultural Chemicals, P. O. Box 430, Yonkers, New York.

# Catherine had NO BATHTUB

Catherine de Medici, luxury loving queen of France, moved her court 90 times in 6 years so that the filthy rooms could be cleaned. The royal palace contained no water pipe nor bathing or washing facilities. Today in the United States, over 80% of homes have bathtub or shower, over 86% have inside toilet.

The American people are using water at greater consumption rate than any other people in all history. Over 250 billion gallons are withdrawn daily from ground, lakes and streams for all uses—an increase of 34% in five years. With population increasing faster than any other Nation on earth, it is estimated that by 1975 there will be 227 million Americans who will require 50% more water than they use today!

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## CONSTRUCTION EQUIPMENT AND MATERIALS

### What You Should Know About Air-Placed Concrete

**67.** For a detailed explanation of the principle of "gunned" or "air-placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the reply card today.

### Davis Back-Hoe and Davis Loader

**312.** Literature is available from Massey-Ferguson Industrial Division, Massey-Harris-Ferguson, Inc., 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

### Catalog on Utility Bodies and Equipment

**360.** General service bodies, line construction bodies, aerial equipment, winch and derrick equipment and trailers are the units covered in this catalog. For design, dimensions, illustrations and descriptions check the reply card or write McCabe-Powers Auto Body Co., 5900 N. Broadway, St. Louis 15, Mo.

### Complete Line of Shovels, Draglines, Cranes and Clamshells

**361.** Bucyrus-Erie crane-excavators in sizes from ⅜ to 4 cu. yd. capacities are covered in literature from Bucyrus-Erie Co., South Milwaukee, Wis.

*Use The Reply Card*

### 4-Wheel Drive Tractor Loaders

**434.** A 16-page Catalog, No. 1033-5-57, describing the "Tracto-Loader Line" of front end wheel loaders is available from Tractomotive Corp., Deerfield, Ill. Covered are the five models that are in production.

### Self-Propelled Ditching Machines

**438.** Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

### Agent For Improving Adhesion Between Old and New Concrete

**530.** Thorobond liquid bonding agent for improving adhesion of new concrete to old concrete walls, floors and ceilings is described in literature available from Standard Dry Wall Products, Inc., New Eagle, Pa. Check the reply card for information on typical uses and methods of application.

### Catalog on John Deere Tractors and Equipment

**588.** Information and specifications on the John Deere "420" crawler and wheel-type industrial tractors are fully covered in catalog from Deere & Co., 3300 River Drive, Moline, Ill. Attachments such as snow plow blades, rear-mounted blades, mowers and angling dozers are described. Check the reply card.

### Slide Rule PSI Calculator For Concrete

**713.** A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

Fast Clean Up
M-B SWEEPERS
Clean dirt, leaves, debris, snow — most everything — from streets, sidewalks, playgrounds, etc. Economical M-B Sweepers fit all popular tractors, many tractor loaders. Available with two-way hydraulic drive and one-way mechanical drive. Your tractor dealer has full details, or write to the M-B Corporation, New Holstein, Wisconsin.
Sweepers to fit every need.
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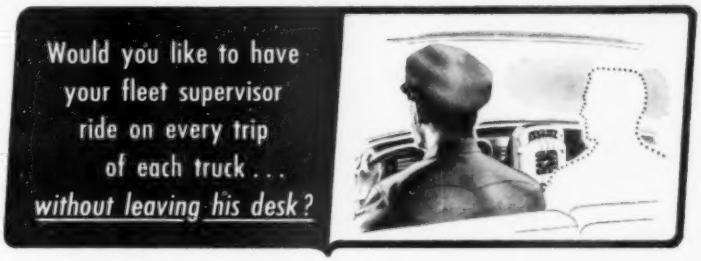


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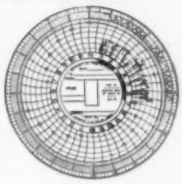
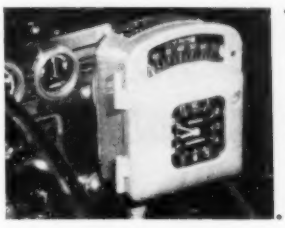


CHART TELLS ALL



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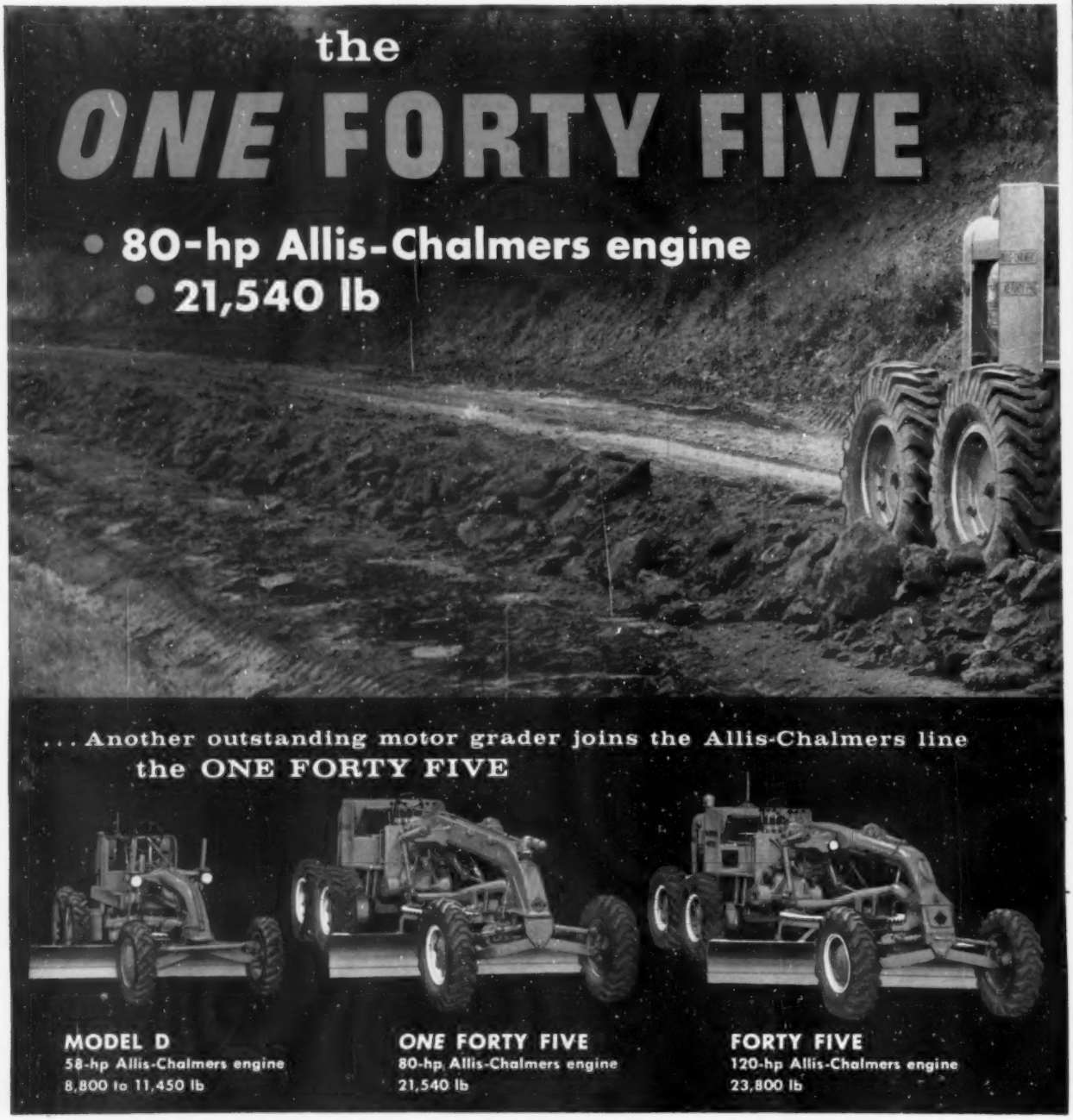
# Allis-Chalmers announces a new motor grader in the 80-hp class

**—designed specifically to meet the grading needs of your community**

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- Heavy-duty throughout at a budget-saving price.
- Designed for city, township, county, state road work—production grading, oil mixing, scarifying, bank sloping, even cutting flat bottom ditches.
- Retains the widely-accepted characteristics and performance features of the 120-hp Allis-Chalmers FORTY FIVE grader.
- Offers the best combination of operator features of any grader near its size.

**Operator advantages** no other medium-priced grader can give you . . . "wide-open" visibility . . . over-the-circle lift cases . . . suspended pedals and exclusive no-kick, toggle-type controls.

**Power for high production.** Husky, high-torque Allis-Chalmers diesel engine handles overloads without shifting down . . . geared for good range of travel and working speeds.

**Load-handling ability second to none.** The new *ONE* FORTY FIVE has a 26⅛-inch-high arched front axle—and highest throat clearance in its class. You get more dirt to the ROLL-AWAY moldboard and move it with efficient rolling action that uses less power.

See the new *ONE* FORTY FIVE motor grader at your Allis-Chalmers dealer's. Check its dollar-stretching price. Then check its 80 hp and 21,540 lb on an actual demonstration. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.

ROLL-AWAY is an Allis-Chalmers trademark.

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# When to use coated or paved Beth-Cu-Loy drainage pipe

Drainage pipe made from galvanized corrugated Beth-Cu-Loy (copper-bearing steel) sheets is both strong and light in weight. Its flexibility permits the pipe to flex with the fill to distribute loads more uniformly around the periphery. Its long lengths and simple field connections speed up installation.

***Combats Corrosion and Abrasion***

But for all these advantages, Beth-Cu-Loy pipe can be even further improved for use in culverts, storm sewers, conduits and other structures where there may be heavy corrosion and erosion in drainage. This is done by coating, or paving, the pipe with asphalt.

*Fig. 1*

A hot-dip coating of bituminous material substantially reduces the effects of corrosive conditions, and adds to the service life of the pipe. In addition, a paving of asphalt to cover the inside crests of the corrugations (see Fig. 1) further protects the pipe from wear caused by erosive materials such as heavy sand and gravel in the stream. The paving covers the inside crests of the corrugations to a depth of ⅛ in., minimum, and is spread over an arc-segment of 90 deg, along the entire length (see Fig. 2). Such paving not only protects the pipe, but also lowers the coefficient of roughness in the bore.

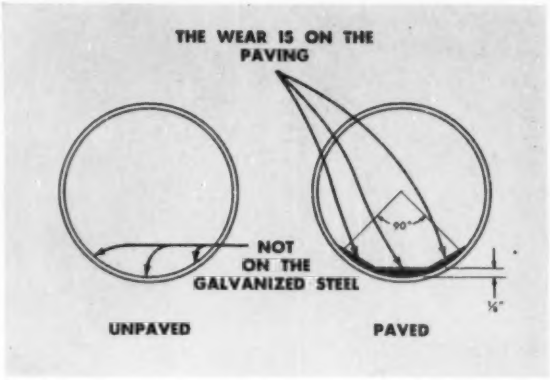


*Fig. 2*

All this and much more about drainage materials and design are fully discussed in a recent Bethlehem publication, Booklet 425-A, "Solving Drainage Problems." This booklet is crammed with illustrations, charts, tables, sketches, and nomographs to assist engineers and public officials alike in solving their drainage problems. It also includes some brand-new tables for evaluating flow friction. Ask your fabricator for a copy.

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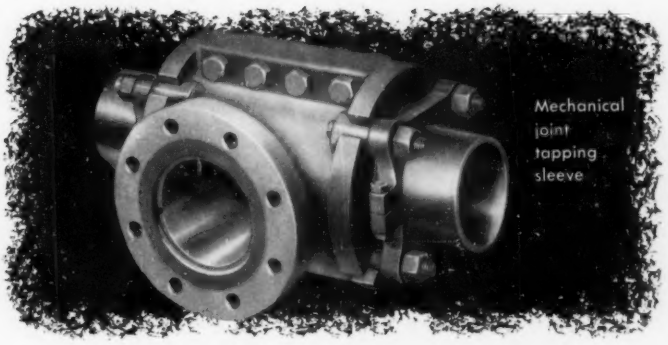

Mechanical joint tapping sleeve

Mechanical joint tapping valve

for simplified, trouble-free

**MODERNIZATION...**
**EXPANSION...**
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Darling gate valve equipped with automatic drain

In meeting your present and future requirements you can benefit greatly by the modern design, unique features and proved performance combined in Darling valves and allied water line products. Shown here are four of the various special-purpose Darling units that are helping effectively and economically to meet growing, changing needs in communities everywhere!

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## AMERICAN

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- ✓ ***DUCTILITY*** **Bends and twists under load... but doesn't break.**
- ✓ ***LONG LIFE*** **Excellent corrosion resistance... confirmed by tests.**

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# Ductile Iron

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### FOR WATER AND OTHER LIQUID SERVICE...

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**EXTRA STRENGTH** — Meets the super-service requirements of . . .
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SHOCK LOADS . . . both internal and external
DEEP COVER . . . unstable bedding
THERMAL STRESSES
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2-8-1

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Company
Street
City State

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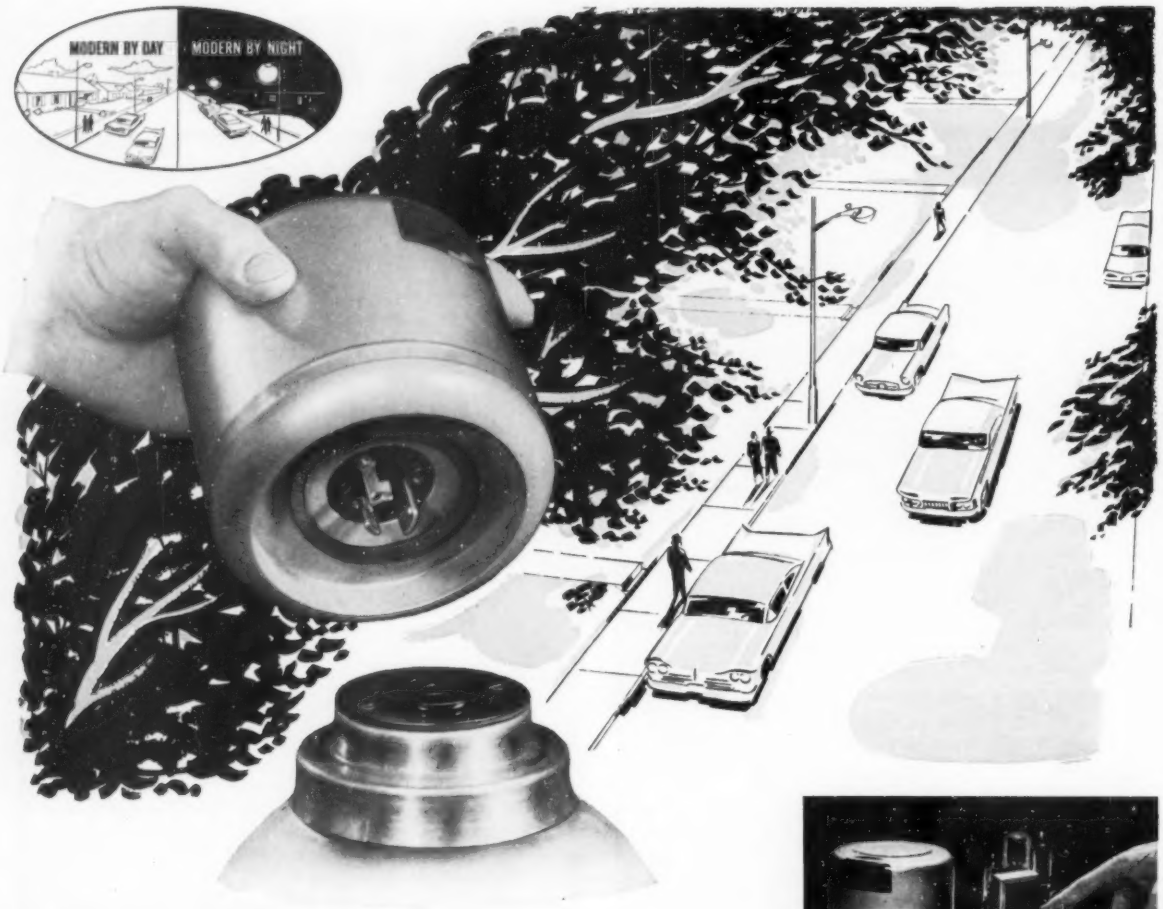


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# NEW reliable, twist-lock photoelectric control

The new General Electric photoelectric control—designed for years of reliable service—will save you money in the long run.

Here are five reasons why:

1. Built-in Thyrite* surge protection at no extra cost.
2. Long tube life achieved by continuous burning of amplifier tubes at well below their rated values.
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For long-range economy in your street-lighting control circuit, call your nearby G-E Apparatus sales engineer or agent and ask to see the new twist-lock photoelectric. Or, write today for all the details. General Electric Company, Schenectady 5, New York. 450-8

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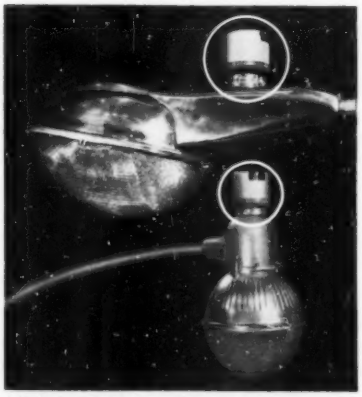
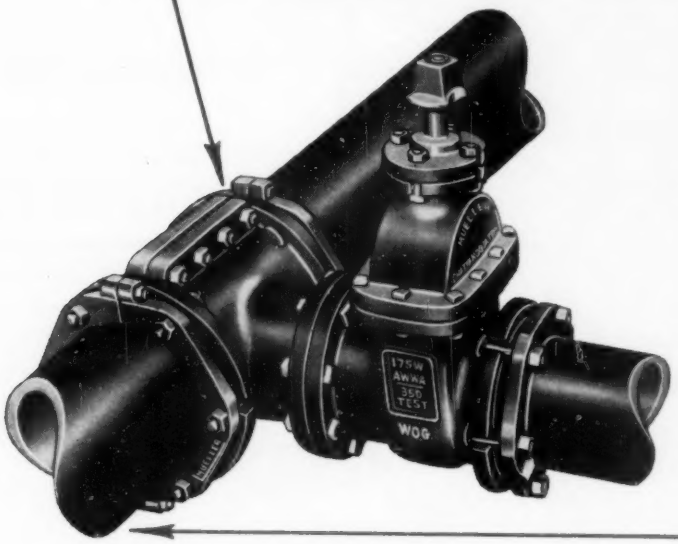
**BUILT-IN THYRITE* PROTECTION**—an exclusive G-E feature—guards against damage from induced voltage surges, eliminates added cost of external secondary arrestor.

*Reg. Trade-mark of General Electric Co.



**ADAPTABILITY**—New photoelectric control fits General Electric mercury "Power Pack" (top) and mercury or filament Form 101 hoods, and is designed to NEMA and EEI standards.

# one tapping sleeve ...




## fits all classes of cast iron pipe regularly used.

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*This simple detail of design is typical of many extra features of Mueller Tapping Sleeves and Valves and Tapping Crosses. It is also typical of the great attention to detail in research, design and engineering that becomes a part of every Mueller product used by the water industry.*

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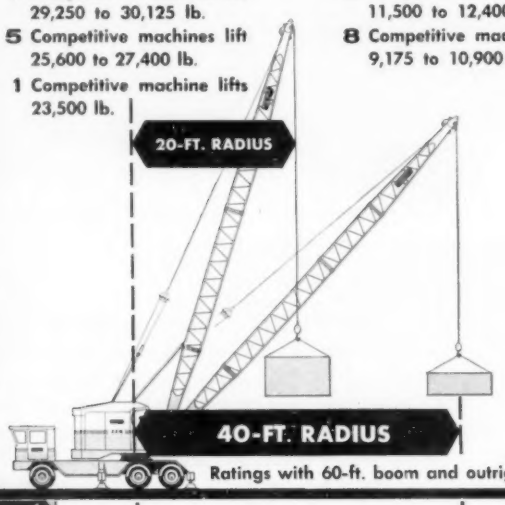


Ratings with 60-ft. boom and outriggers set.

**This is where MOST WORK IS DONE!**

☆ **There's unusual stability** in the 22-B's wider spread outriggers. On the job, owners pull beams out to full 15-ft. spread, block them up — they're ready to work.

See your BUCYRUS ERIE® Distributor . .

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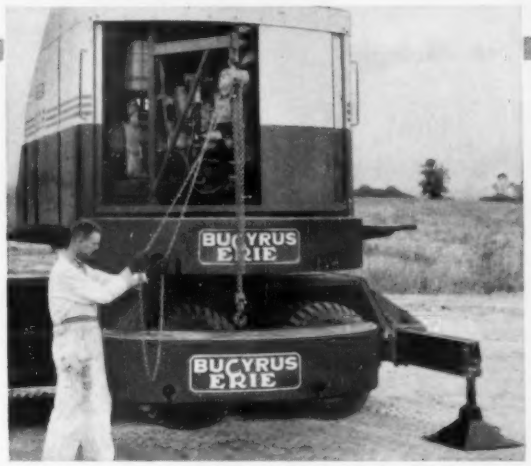
*Compare the capacities, compare the features!*

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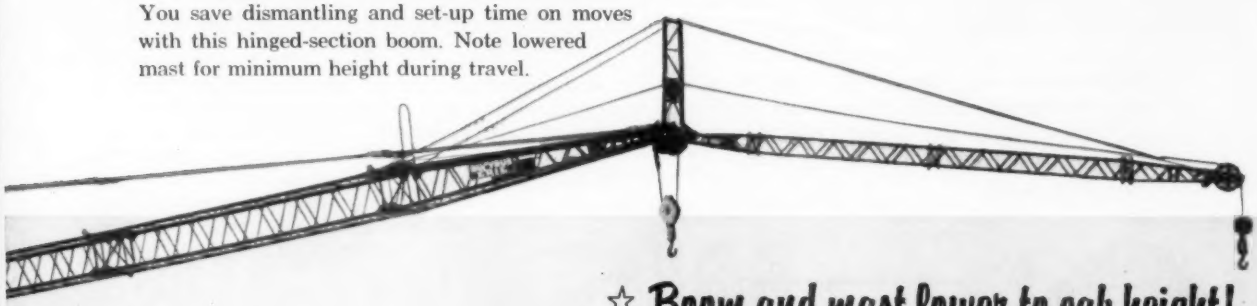
- Conical Hook Rollers

## ☆ Strips fast for travel!

Counterweight drops fast! Lowering time is cut to minutes by this special jib crane. System is manually operated, lets you drop counterweight to ground or low-boy trailer.

## ☆ Folding booms cut move time!

You save dismantling and set-up time on moves with this hinged-section boom. Note lowered mast for minimum height during travel.



## ☆ Boom and mast lower to cab height!

Booms up to 75 feet with or without mast can be lowered to cab height for traveling, *without* dismantling. 22-B picks up to 130 feet of boom and jib from ground without outside assistance!

## ☆ High alloy steel booms

are 50% stronger than ordinary structural steel booms, yet lighter in weight. Owners lift more PAYload . . . less DEADload!

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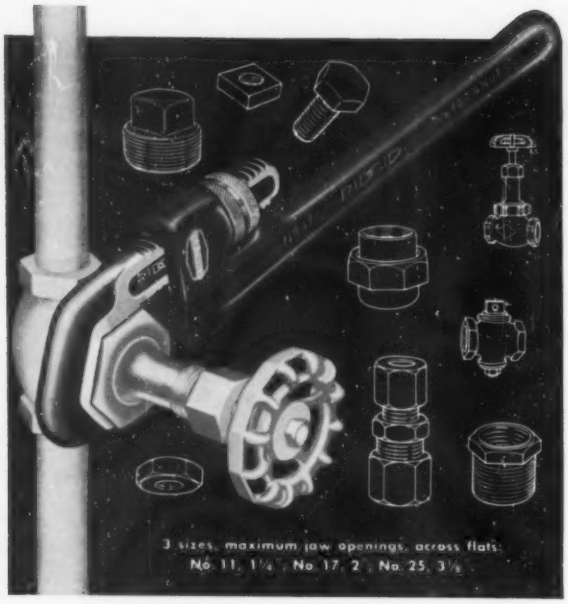
**. . . He will show you a 22-B in action!**

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**Wide-open fast-action multi-sided grip on every hex, square and flathead!**

Quick adjustment—stays to size . . . this new Hex Wrench goes on easily, won't slip off—harder you pull, the tighter it grips . . . no more skinned knuckles or rounded nut shoulders! Narrow jaw for close quarters. Famous RIDGID heavy-duty design, guaranteed housing, comfort-grip handle. Three sizes for ⅜" to 2" nuts. Make your work easier and faster—buy new RIDGID Hex Wrenches at your Supply House!

THREADED PIPE... *It's Tight... It's Best... Costs Less!*

# COMMENTARY on WATER and SEWAGE TREATMENT

## ARE SLUDGE DIGESTERS OBSOLETE?

**R. S. RANKIN**

**Consultant, Water and Sewage Treatment**

JUDGING FROM recent technical articles and other publicity the digester in sewage treatment plants will soon become obsolete or an economical liability. According to these, instead of digesting the sludge, mechanical dewatering of the raw sludge is proposed for the smaller plants with land disposal of the raw sludge cake. It seems pertinent to examine this proposal which is such a radical departure from what has become accepted practice. This discussion does not refer to practices such as raw sludge dewatering followed by incineration, barging to sea, or to activated sludge processing for fertilizer. It refers solely to the elimination of digesters and, instead, dewatering the raw sludge and disposing of the cake without further treatment.

Raw sludge dewatering by mechanical devices is not new and, in fact, was one of the earliest methods of sludge treatment dating back to around 1880. This practice was applied to a number of early plants in England and the United States particularly those using chemical precipitation. Plate and frame filter presses were used with pressures far exceeding those in the vacuum filter of today. The sludge was usually conditioned with lime, and cake moistures of 55 to 65 percent were quite common. In these early plants cake disposal became a continuous problem as it created a nuisance unless plowed under or buried in trenches and available land seemed constantly to diminish. Consequently, it is not surprising that the invention of the Imhoff tank embodying sludge digestion was received with enthusiasm. It seems strange that practices abandoned in favor of digestion 40 to 50 years ago should now be promoted as the latest. Even though the equipment is different, the end results are the same.

From a bacteriological standpoint raw sludge filter cake, when limed to a high pH, may be no more hazardous than digested sludge, due to the bactericidal effects of caustic lime, which incidentally have long been recognized; but other species of pathogens present in raw sludge which are not affected by lime will not survive digestion. Aside from hygienic factors several other aspects to the disposal of raw sludge provide reasons for its widespread discontinuance in favor of digestion.

Raw sludge is more odorous; its grease content is roughly four times as high as that of digested sludge thereby retarding assimilation into the soil. Raw sludge is not readily converted to humus nor is it available to soil bacteria except after prolonged storage. A number of states prohibit the application of raw

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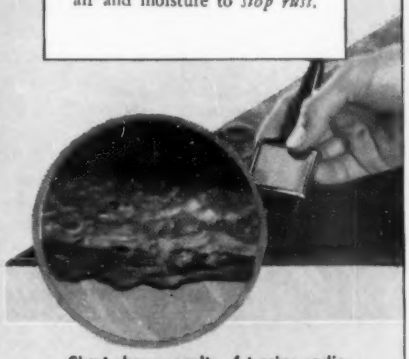
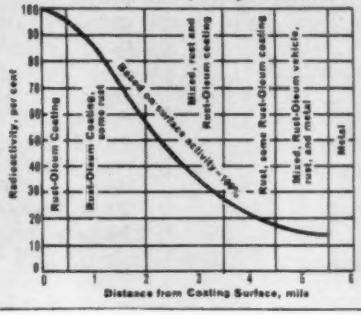
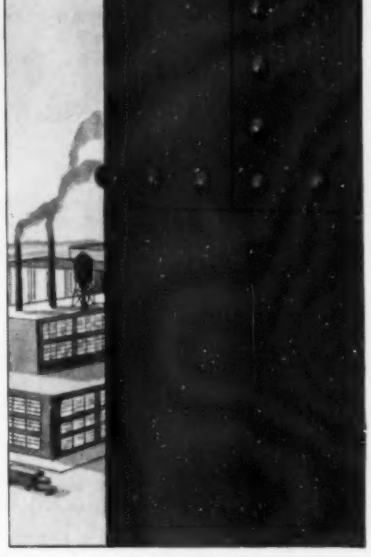


Chart shows results of tracing radio-activated Rust-Oleum through rust to bare metal by Geiger Counter.




## LASTS LONGER

Applied over rust, Rust-Oleum lasts longer for the *over-the-years protection* you need. It resists sun, salt water, salt air, fumes, heat, humidity, moisture, weathering.



These are just a few of many important *differences* that separate Rust-Oleum from ordinary coatings. When you consider that Rust-Oleum covers approximately *30% more area*, depending upon surface condition and porosity . . . and the fact that Rust-Oleum finish coatings are available in nearly every color for the beauty you want plus *double protection* . . . it's just good, common sense to use Rust-Oleum. Prompt delivery from Industrial Distributor stocks. Write for illustrated literature with color charts, and for the complete 30-page report on Rust-Oleum penetration.

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**Air, oil, water, electric or manual operation.**

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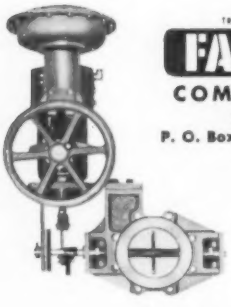
**Specializing in large butterfly valves.**



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An 8" FIG. 55 valve utilizing diaphragm operator, positioner and handwheel declutching unit

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sludge direct to the soil, and of course, the Federation of Sewage and Industrial Wastes Associations went on record in 1946 in its Manual of Practice No. 2 as opposed to the use of raw primary sludge in any form as a fertilizer. The Minneapolis-St. Paul Sanitary District has had many years of experience in producing raw sludge cake for incineration, and according to the 1956 Annual Report, does not permit diversion of any of the cake to farmers until it has been stockpiled for one or two years. Over a 10-year period less than 1 percent has been used for fertilizers. A one-year stockpile of the entire output around the average plant could create quite a problem. Since continuing depletion of humus in the soil is a long recognized fact, the logical procedure is to add the sludge in a form in which it can most readily counteract this deficiency.

Claims are made that plant costs can be reduced by omitting digesters and filtering raw sludge. Anyone will agree that cost saving is a desirable objective but it is not a primary one. In fact, it is possible that, if cost is a main consideration, a few additional acres of land could be purchased at the plant, the raw sludge pumped to it and plowed under thereby dispensing with any dewatering equipment. This too was good practice until digestion came along and it was eventually discouraged by health authorities.

Dewatering raw sludge may not prove as economical in the long run as might be expected. Digestion will reduce the solids 40 to 50 percent so that the filter must have from 75 to 100 percent greater capacity for raw than digested sludge. Also, the raw sludge filter must handle peak daily loads which can be up to 200 percent of average. The digested sludge peak loads will usually not exceed 150 percent of average. Combining these factors will result in a raw sludge filter capacity of twice that required for digested sludge. The raw sludge dewatering facilities preferably should be in duplicate as delays due to breakdown of any equipment should not be tolerated. When filtering digested sludge, delays of a few days for repairs are of less consequence as a digester is usually sufficiently flexible in capacity to tide over inoperative periods. It is possible, of course, to carry spare parts for emergencies in either case.

When filtering raw sludge a storage tank is needed to balance sludge production with filter operating time. With a 5-day work week, storage for at least two full days is necessary and this should be based on peak production unless overtime operation is scheduled.

Operating costs for filtering raw sludge will exceed by a considerable margin the cost of filtering elutriated digested sludge. In addition to the increased amount of solids in the former, variations in quality of raw sludge permit less day-to-day precision in chemical additions resulting in frequent overdosing to assure results. When these differences in chemical costs are totaled over a year, the capitalized saving by filtering elutriated digested sludge instead of raw sludge will go a long way towards financing the digesters. Even without elutriation the saving is substantial when using the newer open weave filter media. Digested sludge can be lagooned or dried on sand beds. It is not as necessary to dewater on vacuum filters as in the case of raw sludge. Objectionable odors are not a problem in digested sludge.

Any engineer contemplating raw sludge filtration as a substitute for digestion should make his own impartial analysis of all factors including initial and operating costs before arriving at any conclusions.

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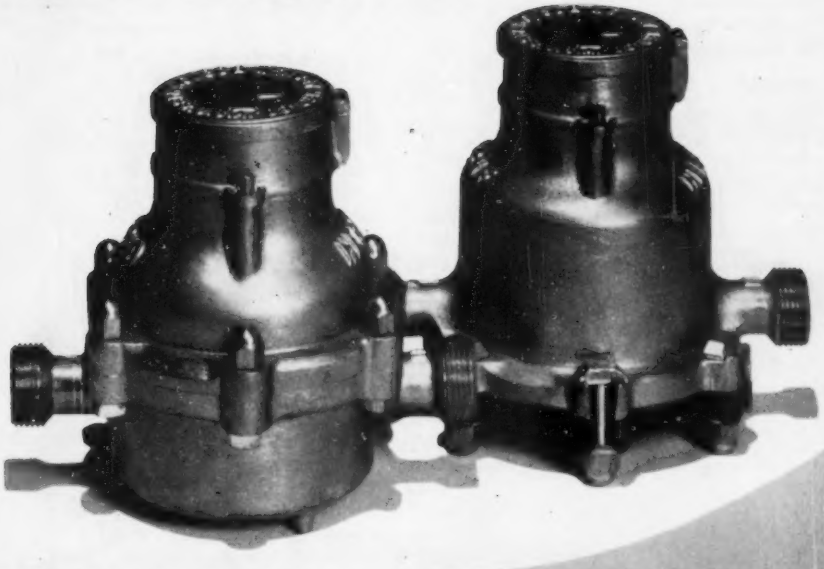

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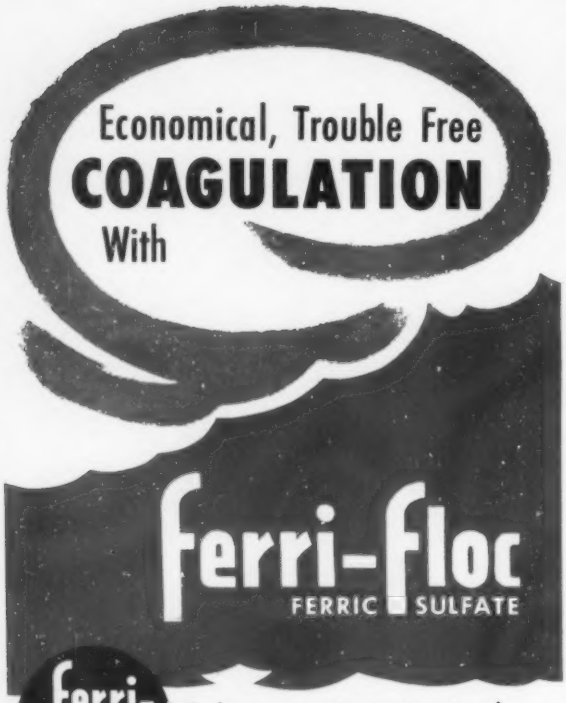


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Digesters may have their weak points but considering the experience gained from the thousands of installations, it is fairly easy to remedy them and to predict performance. Digesters also produce gas which has a definite value as fuel or power, or both. Furthermore, the ultimate objective in treating any sewage always has been to achieve stabilization of the component elements so that they are rendered inoffensive. One major step in this direction is the anaerobic decomposition of the solid constituents. Great forward progress in this direction was made when digestion was introduced into the field of sewage treatment. It seems unrealistic to think of abandoning 50 years of such practice.

### New York State Thruway Design and Maintenance Details

The New York State Thruway is the longest and greatest toll expressway in the World. A total of 538 miles of the cross-State system is open to traffic (as of October 18, 1958), with the remainder of the 559-mile network under construction and scheduled for completion before late 1960.

The Thruway is generally a four-lane concrete highway, comprising two lanes for traffic in either direction, separated by a mall, ranging up to 1,025 feet in width. Six lanes are provided in areas of heavier traffic, totaling 66 miles. All four-lane sections are designed so that two additional lanes may be built without acquiring additional right-of-way or reducing the mall to less than 20 feet. Sight distance of at least 1,000 feet is provided to eliminate blind spots for the fast-traveling motorist. There are no intersections at grade, no sharp curves and no steep hills on the Thruway.

Signs or advertising devices may not be erected or maintained within 500 feet of the nearest edge of the pavement except with specific permission from the Thruway Authority.

Maintenance of the Thruway is handled by a specially trained staff. It keeps the highway and the hundreds of bridges in top shape throughout the year. Special techniques are utilized during the winter months to control snow and ice, and keep the superhighway open for high-speed traffic at all times. Maintenance operations are administered through regionalized field offices, located with headquarters at various key Thruway interchanges. Each section headquarters is staffed and equipped to operate its own maintenance program within its specified area.

### Turnpike Location Requires Extensive and Costly Utility Changes

The Richmond-Petersburg Turnpike construction required that more than 17,000 feet of gas mains and 20,000 feet of water mains be removed or relocated by the City of Richmond. Approximately 1,000 house services were killed and miles of street lighting circuits were removed or relocated. The Turnpike crossed the City storage yards and it was necessary to relocate the facility.

A new storage and warehouse facility was constructed with improved handling equipment and physical layout resulting in savings of man power costing $6,400 annually. Space is now available to consolidate in one location all items which formerly were stored in four scattered locations. This, with twenty-four hour supervision, affords better control over issues and inventory at the new central storage facility.

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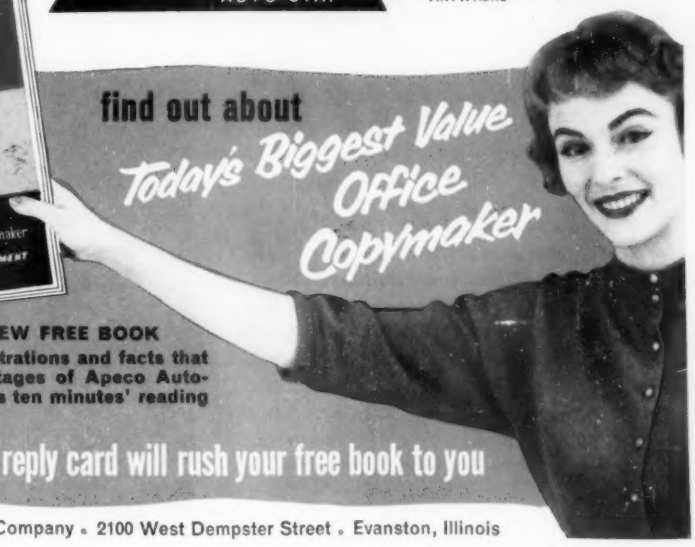

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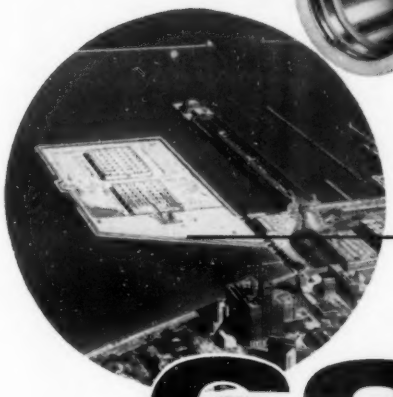
# CLOW

Start of installation of Clow cast iron pipe with intermediate Bell-Tite joints in one of 192 half filter beds which compose the filter underdrain system. The Bell-Tite flare tees are first set in concrete. Note Chicago skyline in distance.

Installation of pipe and tees partially completed. Clow Bell-Tite joints permit easy and rapid assembly—an important factor especially in a job of this magnitude. Bell-Tite forms a pressure-tight joint instantly. Photo shows Neil Sullivan, pipe foreman for George D. Hardin, contractor (right), and Lewis C. Alk, Manager, Clow Technical Service Department.

CAST IRON

# PIPE



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# 62 MILES OF CLOW CAST IRON PIPE

## *in filter underdrain system*

Chicago's new Central District Filtration Plant, now under construction, will be the largest in the world. Located on a 61-acre tract of filled-in land on Chicago's lake front, it will have a normal capacity of 960 million gallons of water a day—a maximum capacity of 1680 million gallons a day. The plant was designed by Department of Public Works, City of Chicago, Bureau of Engineering, Filtration Design Division.

Over 62 miles of Clow 4″ cast iron pipe—27,264 runs of pipe with 13,632 Bell-Tite® and flare tees compose the underdrain system for 192 half filter beds. Each pipe length is supplied with perforated holes with brass eyelets and has a cast iron plate welded in one end. Each Bell-Tite tee has two eyelet holes.

Easy, rapid assembly permitted by the Clow Bell-Tite joint contributes greatly to economical installation.

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CLOW CAST IRON PIPE

# EMERGENCY START-UP POWER SUPPLY

**BRUCE J. ENNIS**
Principal Engineer,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

ALL ELECTRIC POWER generating stations fall under one of two categories. They are either: (1) part of a system which is interconnected with other utilities and power plants by transmission line or distribution system feeders; or (2) part of a system which is electrically isolated from other utilities and power plants. In either case the possibility exists for partial or complete disruption of service in the output of the plant. A station which is operating normally one minute may be completely shut down and dead the next minute due to a number of causes such as errors in operational procedures, failure of major or minor plant equipment, the effects of lightning, sleet and wind storms, or the unfortunate compounding of these factors. In case of such a shut down, it is of prime importance to get the plant back into operation in the shortest possible time and to pick up system load with the minimum disruption of service to the utility's consumers.

Generally speaking, a system which is interconnected through transmission lines or feeders of adequate capacity to another utility having surplus spinning reserve has a built-in source of emergency start-up power supply. By reclosing tie circuit breakers and reenergizing plant auxiliary equipment in proper sequence, plant down-time may be kept to a minimum.

In the case of the isolated system, there is no such help available from an adjacent utility, and the system must be provided with an inherent source of emergency start-up power supply of sufficient capacity to permit the rapid reenergization of plant auxiliary equipment following a shut-down.

For plants in this category, the usual source of start-up power is obtained from an internal combustion engine-generator set of the diesel oil, gas, dual-fuel, or gasoline type. Such sets, depending on size, may be started up manually or automatically and put on the line, ready to pick up station auxiliary equipment loads, in a matter of from a few seconds to a very few minutes.

For the small to medium sized diesel engine type of power plant, the start-up power supply may consist of a small gasoline engine driven air compressor, to provide compressed air for the start-up air tanks.

For the large diesel engine plant, a small self-contained engine generator set should be provided to energize auxiliary equipment including electric motor driven air compressors for start-up air supply, motor driven cooling water pumps, and lubricating oil pumps. Such a house service generator set should, of course, have sufficient capacity to handle the auxiliaries of at least the smallest main diesel engine unit in the plant. Sometimes a smaller, older unit in a plant is used for the start-up power supply for newer and larger units.

Start-up power for a hydroelectric station should consist of a similar engine generator set to provide lubricating oil pressure, hydraulic governor oil pressure, and power for motorized gate and valve operator auxiliary equipment which must be in operation prior to permitting the flow of water to the main hydraulic turbine, unless, of course, the plant contains a small hydro house service unit.

Start-up power requirements for a steam generating station vary considerably, depending on the type and size of plant. Some plants may be started up without any auxiliary power supply by using gas firing and natural furnace draft to build up steam pressure to operate auxiliary equipment; however, this method of operation is not flexible, and it is time consuming. In general, a house service set for such plants should be of the diesel or gas engine generator type having sufficient capacity: (a) to provide an electric power supply to drive simultaneously all auxiliary equipment associated with at least one main generating unit; and (b) to permit starting the largest motor of such auxiliary equipment without creating a plant auxiliary bus voltage dip of sufficient magnitude to cause other auxiliaries to drop off due to the action of undervoltage relays, contactors, or motor starters, when subjected to subnormal voltages of approximately 75% or less.

In order to point up these requirements, data pertinent to the specifications for a start-up power generator set needed for a typical 25,000 kw steam turbine generator and pulverized coal fired boiler unit plant have been condensed hereinafter as follows:

In this plant, oil light-off firing permitted dispensing with the normal 200 HP motor load associated with a pulverizer mill. The total auxiliary load, with oil firing was 1335 HP including a normal boiler feed pump motor of 600 HP as the largest motor to be started. Actually only 150 HP of boiler feed pump capacity would be required to supply the boiler water requirements for plant start-up.

Assuming 85% power factor for the auxiliary motors and 88% efficiency, the input capacity to the plant auxiliaries from the start-up power generator set would be:

$$\text{Generator output} = \frac{1335 \text{ HP} \times 0.746}{0.85 \times 0.88} =$$

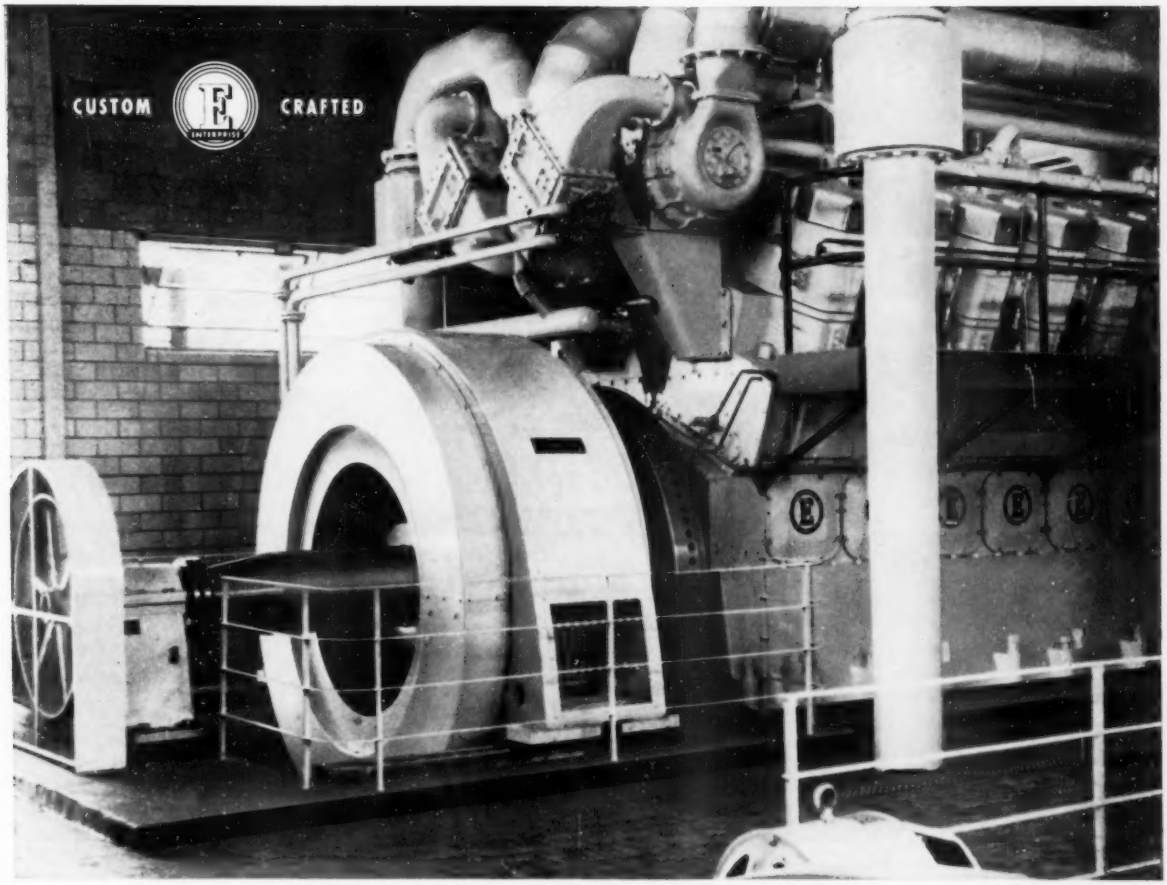
1335 kva = 1135 kw.

For diesel electric units, assuming 94% generator efficiency, Engine HP x 0.7=Generator kw, or the diesel engine HP=1135÷0.7= 1600 HP, approximately.

On this basis, a 1600 HP diesel engine driving a generator rated at least 1135 kw would handle the full load requirements of the plant auxiliaries, once the equipment was in operation and on the line. However, as a rough rule, a diesel generating unit with normal flywheel effect can suitably start up a motor from rest only when the motor HP is 1/3 or less of the engine HP. Therefore, the 1600 HP engine could not start up a motor larger than 533 HP, which is less than the normal 600 HP boiler feed pump associated with the boiler.

In this case, two alternates were possible:

1. Provide a large slow speed diesel unit for emergency start up




# World's Smallest Big-Horsepower Engine Now at Work for Waverly, Iowa

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As with other custom-crafted models in the complete Enterprise line, this 110-ton engine offers many advantages which cut installation, operating and maintenance costs. Less bulk makes installation easier, servicing simpler and more economical. Maintenance requires no major disassembly because all working parts are readily accessible from the outside.

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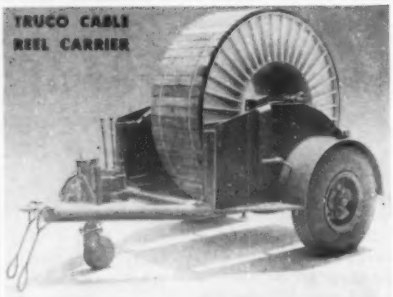
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power, having a rating of at least 2100 HP and with an oversized 3750 kva, 70% power factor generator (to minimize voltage dip on starting the 600 HP boiler feed pump motor), or

2. Provide a 1600 HP, 1135 kw high speed diesel unit and a special 150 HP "start up" boiler feed pump. Such a unit would have sufficient surplus capacity to provide miscellaneous plant loads, such as station lighting.

In this case, the second alternate proved to be the best solution, economically, at a savings of several thousands of dollars.

Regardless of the type or size of plant, the problem of providing an adequate and reliable source of emergency power to permit rapid start up of a plant following a shut down is of primary importance to system management. An appraisal of individual system requirements will indicate whether or not existing start up equipment is sufficient to assure dependable service with the minimum of down time and whether or not additional internal combustion engine driven start up equipment is desirable to promote service reliability. This is especially true in plants where a small, easily started unit has been retired and replaced with a larger unit with heavier starting power demand requirements, or where a complicated and time consuming start up procedure is required to get plant units back on the line with inadequately sized emergency power generating sets.

The emergency generator unit should be provided with an automatic voltage regulator having a sensitivity of one-half of one per cent of normal line voltage and with maximum speed of response based on the time constants of the generator being regulated. As a general operating procedure, the largest auxiliary motor should be started first, with no other load on the emergency generator. In cases involving difficult start-up duty, the voltage level of the generator may be raised abnormally by manual adjustment prior to energizing auxiliary equipment motors, to compensate for subsequent voltage dip.

In order to assure dependability, the emergency power generating set should be started up once a week, synchronized with the plant bus, and allowed to carry full load for an hour or so.

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**Powerful broom-and-vacuum system** picks up the fine dust that's usually missed . . . as well as heavy, bulky debris. A huge 540 square foot filter gives almost perfect dust control. There's no need for water spray... thus no winter freeze-up problem.

This means your town can now have ultra-clean sweeping *even on the coldest winter days!*

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"In addition to our sand and gravel business, we have ten Ford F- and C-800 tractors that make long, over-the-road trips hauling limestone one way and steel on the way back.

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Whatever your job . . . wherever you do it—you'll find Ford Heavies and Extra Heavies are engineered and built to do it better! And the '59 improvements in these models will bring still more benefits to your operation.

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Yes, the new '59 Ford trucks are here to take you *Ford*-ward for savings, *Ford*-ward for modern style and stamina.

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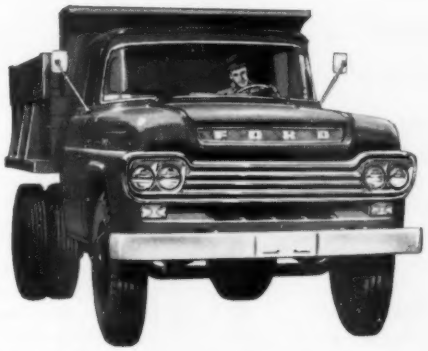


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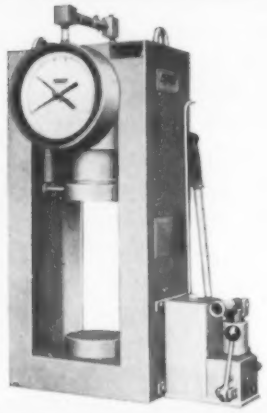

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# LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

### *Water and Sewer Services*

*VMJ Company v. City of Lorain*, 151 N.E. (2d) 667, an Ohio case decided Nov. 6, 1957, was an action by the VMJ Company seeking a declaratory judgment to the effect that it was entitled to have water and sewer services from the City of Lorain.

The Company was planning to build a Shopping Center consisting of 26 stores under one roof, 9 of which were to be within the city limits of Lorain, and 17 of which were to be outside the city limits.

The City had, by law, *authority* to provide such services outside its limits (up to a certain extent), but the question was whether it could be *forced* to do so.

The court said that, as a general rule, an inhabitant of the City is entitled to these services. If a single home happened to be on the boundary line, the inhabitant would not have to create a dividing line in the premises and confine the water and sewers to the city's side. He would be entitled to service. Similarly, in the case of an industrial building or land which constituted a single parcel wholly occupied by the owner, he should be entitled to these services, even though part of the land is outside the city limits.

However, the court held that, in the present case, the situation was different. Here the stores were to be occupied by individual proprietors, some of whom were simply *not* inhabitants of the city. Therefore, such proprietors were held not to be entitled to these services from the City of Lorain.

### *Some Dump*

*Beebe v. City of Toledo*, 151 N.E. (2d) 738, an Ohio case decided July 9, 1958, was an action maintained by a person who was injured by the explosion of a phosphorus grenade in a dresser which had been discarded in the city dump.

The plaintiff had just unloaded a truckload of rubbish on the dump, which was operated and maintained by the city for the use and benefit of its residents. Just before he was about to leave, the explosion occurred, about 50 feet away from the place where he had dumped his rubbish.

There was some evidence to indicate that the dresser had been placed on the dump only about an hour before the explosion, but there was no evidence of who had brought it there.

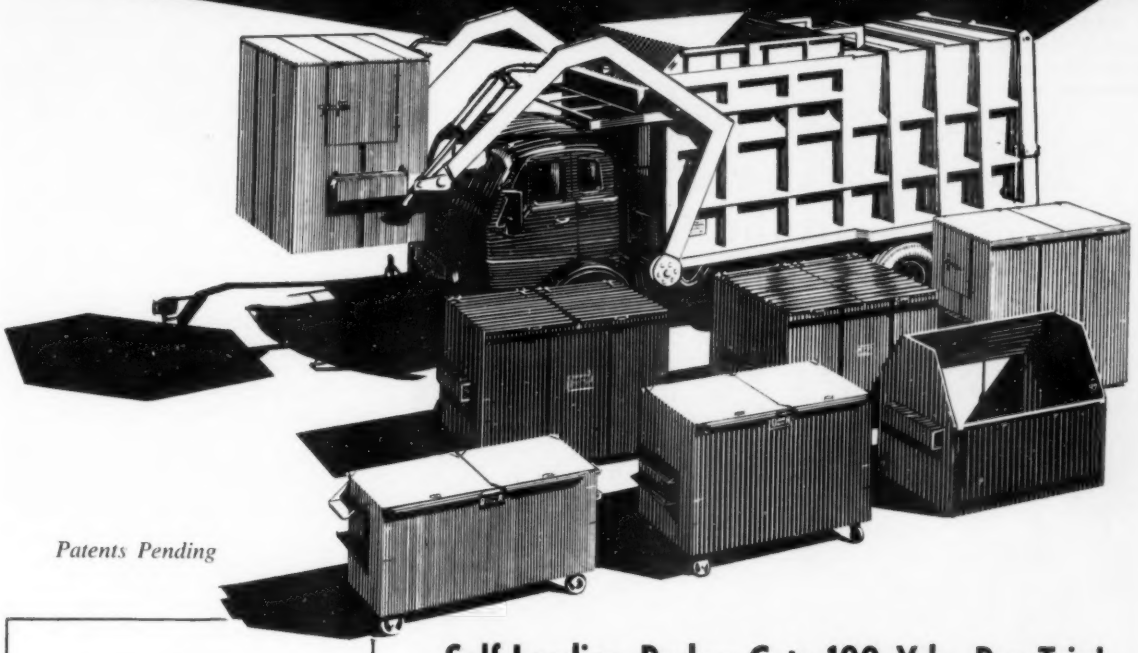
The court held that the city was not negligent in failing to inspect the rubbish dumped for explosives, and that the city was not chargeable with notice that the dump constituted a nuisance at that particular time. Therefore, judgment was rendered for the city.

### *Municipal Garages*

*Cutnaw v. City of Columbus*, 152 N.E. (2d) 27, an Ohio case decided February 28, 1958, was an action to recover damages sustained to plaintiff's automobile while it was parked in a city-owned garage. The plaintiff was the owner of a 1951 Oldsmobile and on May 4, 1956, he delivered it to the Long Street garage in the City of Columbus, Ohio. Upon his return, he was informed that the car had been damaged while being parked in the garage by an attendant of the garage. The attendant was an employee of the City, and had been acting within the course of his employment at the time of the damage to the automobile.

In the trial court, judgment was rendered for the plaintiff in the amount of $300. On a motion for judgment notwithstanding the verdict, the City claimed that: (1) no negligence had been shown; and (2) even if there were negligence, the operation of an off-street parking garage is a governmental function and hence the City is immune from tort liability.

# DEMPSTER-DUMPMASTER Slashes Refuse Collection Costs to New Record Low!



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## Self-Loading Packer Gets 100 Yds. Per Trip!

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The DEMPSTER-DUMPMASTER is versatile . . . can be used on hand-loading routes when it is not handling containers. It's SAFE! . . . lifting arms bridge the cab windows at all times . . . no chance of injury to driver's head or arms. Write today for complete information.

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The court held that there was sufficient evidence of negligence for the jury, and that the operation of a city owned parking garage is a proprietary, rather than a governmental function.

The court said: "Here we have what is ordinarly a private business being operated by government. It is conceded that a fee is charged for parking; that tremendous receipts are taken in yearly, and that the garage is run as a business. Surely in view of the seriousness of a traffic problem in our modern society, the operation of a parking garage has a 'public purpose', but it is not a governmental function."

Therefore, the City's motion was denied, and judgment for plaintiff in the amount of $300 was entered.

### *Swimming Pool Accident*

*Barrett v. City of San Jose,* 325 Pac. (2d) 1026, a California case decided June 2, 1958, was an action for an eye injury sustained by a child while swimming in the municipal pool.

Janelle Barrett, playing in the shallow end of the pool, donned a glass face mask and dove under the water. She came up at the foot of the slide just as another child came down the slide head first. His head struck hers. The glass of the face mask was shattered and a piece of glass was driven into her eye, necessitating removal of the eye.

At the trial, judgment was rendered for the plantiff. On appeal, the court held that the operation of the pool was in a governmental capacity; hence there could be no liability unless (as provided by statute) a dangerous or defective condition (i. e. a nuisance) existed, which the municipality had notice of and had failed to correct. At the original trial, the court had not ruled on this question, but had left it to the jury. The appellate court held that this was error and remanded the case for new trial, with the following instructions: If, at the new trial, the jury finds that the only negligence was that of the lifeguards employed by the City, the City is not liable, because of its governmental immunity. But if it is found that the location of the slide in the pool, and the means used to warn swimmers away from the area adjoining its foot, constituted a "dangerous and defective condition" (i.e. a nuisance), the City would be liable.

• • •

### Rusting Rates of Various Cities

A "Rust Index" has been prepared by Rust-Oleum Corp., which shows the comparative rates of rusting in all cities of more than 10,000 population. This index is based on a long-time research program in which uncoated steel panels were exposed (28 gauge, low carbon, cold roll sheet steel). Periodic examination provided the data. Of the 523 cities listed, 221 are indexed as class 1, meaning the uncoated steel panels rusted to "a severe degree" in less than four years. High rates were found in Buffalo and Rochester, N. Y., Erie, Pa., and Miami, Fla. Low rates were found in Roswell and Santa Fe, N. M., and Tucson, Ariz. Other high rate areas are Pittsburgh, Cleveland, Chicago, New York, Philadelphia and Detroit. Write to Rust-Oleum Corp., 2698 Oakton St., Evanston, Ill., for further information.

• • •

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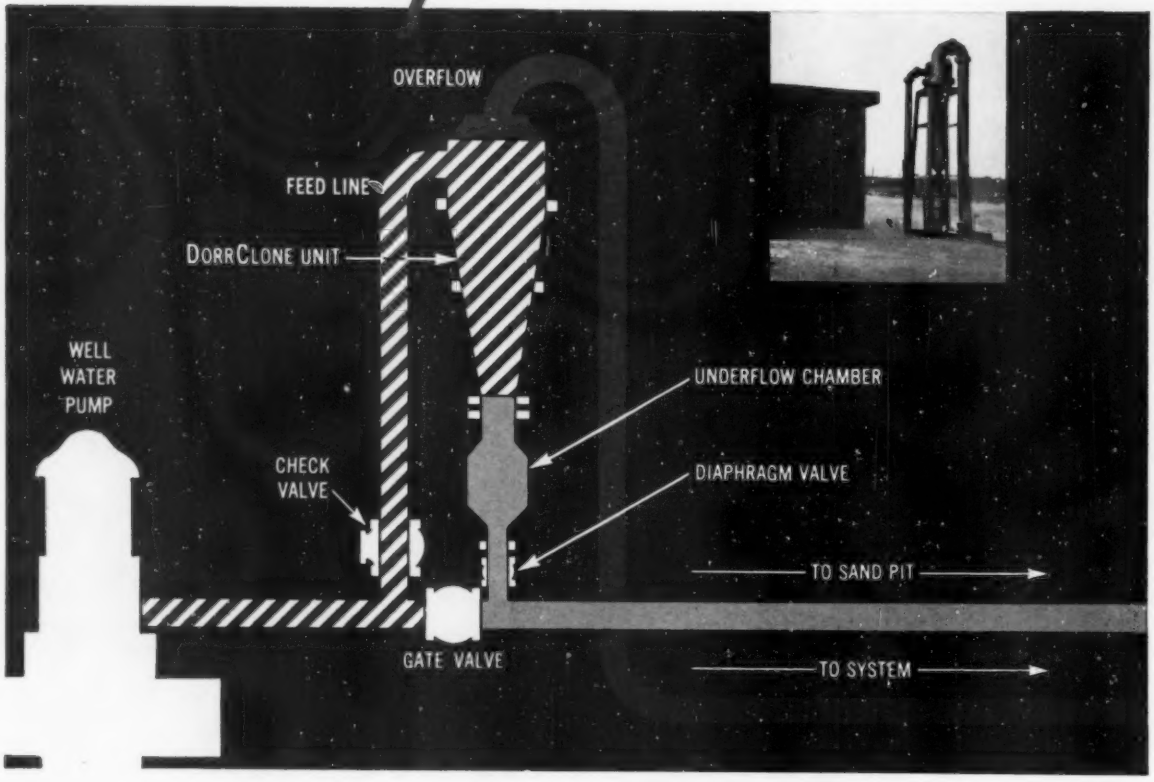


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Heart of the system is in the DorrClone unit, a cylindro-conical shell, shown diagrammatically above. In operation, raw feed water enters tangentially under pressure at the top. A vortex action is created, throwing sand particles to the walls of the cone and down to the underflow at the bottom. Sand-free water at the center of the vortex flows out the top to storage, a treatment plant, or directly to the mains.

The simplicity of the DorrClone desanding system is demonstrated in the installation at Hobbs, New Mexico, shown in the small photo. Units may be designed to suit practically all well water systems. For full information, write for a copy of Bulletin No. 2507.

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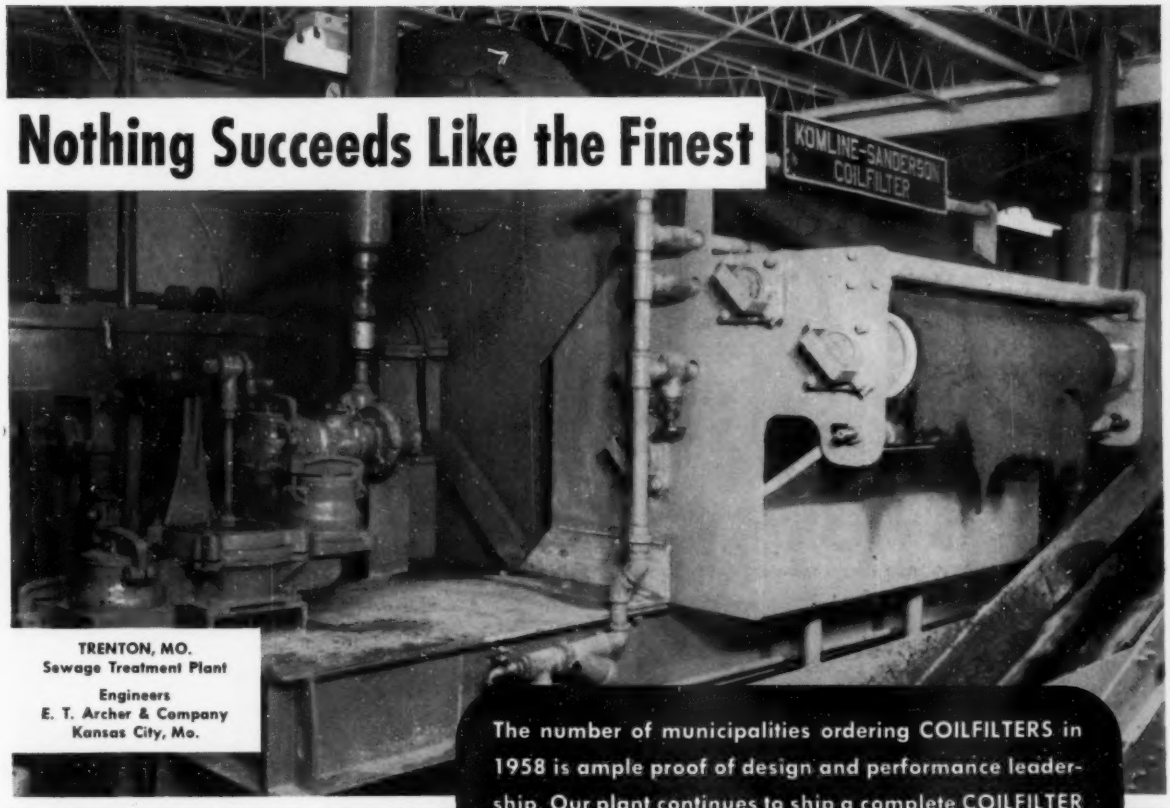


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This section of cast iron pipe laid in Lynchburg, Va., in the late 1820's and uncovered more than a century later in 1936, was still usable. Note that it carried a heavy load of rock as well as street and rail traffic all these years.

When you specify the pipe for water works or sewer main improvements or extensions in your community, consider these facts:

***First*** **— cost of the pipe on your job will be a minor part of the total outlay, regardless of what pipe material you use.**

***Second*** **— differential in the cost of permanent Cast Iron Pipe and non-metallic substitutes will be negligible in relation to the over-all cost of the project.**

***Third*** **— the amortized cost of Cast Iron Pipe over its period of useful, trouble-free service—100 years or more—will be far less than that of any other pipe that you can buy at any price.**

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*In government, as in business, this low-cost photographic process simplifies daily routines*

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No matter how fast the Medina County birth rate rises, you can count on its Health Department's record-keeping being up-to-date. Completely accurate, too.

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Ted W. Brown, Secretary of State of Ohio, reports saving $27,000 a year for taxpayers by making Recordak Microfilm copies of the hundreds of corporation documents received each day by his office.

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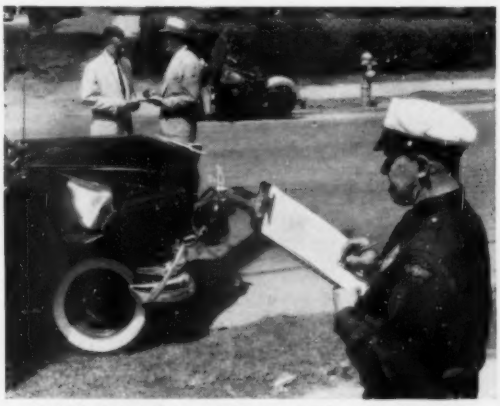

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Paper work piles up in a police department, as in any other busy office. Including accident reports, there are about 300 reports filed each day by the Rochester Police Department.

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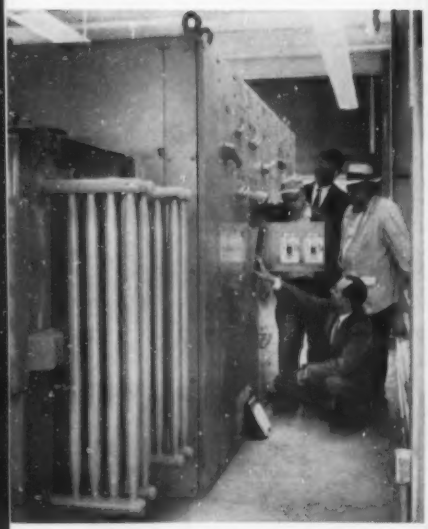
View from pump floor in Oswego, New York, pumping station showing one of main pumps being driven by Westinghouse 300-hp vertical synchronous motor above.



Robert B. Stannard, Resident Engineer for Nussbaumer, Clarke and Velzy, Consulting Engineers; Karr Parker, Jr., Buffalo Electric Co.; Kenneth D. Jensen, Superintendent, Department of Water, Oswego; and M. B. Trimble, Westinghouse Construction Sales Engineer, discuss "tilt-out, lock-out" feature of the control center. Westinghouse double-ended control power center has 300-kva Inerteen® transformer at each end.

# Oswego water pumping station Powers-Up to attract new industries

The modernization and expansion program of the Department of Water, Oswego, N. Y., provides an interesting example of building today for tomorrow's needs. While planning for today, Oswego's Water Board recognized that a good water supply is an indispensable commodity in attracting new industry to the area. By Powering-Up electrically, their new pumping station has electrical capacity five times present demand to allow for future growth.

Present demands for water are approximately 10 million gallons per day. Installed pumping capacity is capable of providing more than 20 million gallons per day. In addition, provision has been made to increase capacity to 35 million gallons per day when required by future demands.

The new pumping station is supplied with lake water from an intake tunnel which extends through solid rock for a distance of 6250 feet into Lake Ontario. This tunnel intake averages eight feet in diameter and is capable of conveying 128 million gallons of water per day.

Electrical power for the station is available from two separate sources—one direct from the Oswego Steam Station and the other from the Niagara-Mohawk Varick Station. The complete electric distribution system, as furnished by Westinghouse, provides for all anticipated future expansion of the pumping station.

Powering-Up electrically for future growth can offer important advantages to you. For further information, call the Westinghouse electrical engineer nearest you, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-94119

**Owner: Department of Water, Oswego, N. Y.**
**Consulting Engineers:**
**Nussbaumer, Clarke and Velzy**
**General Contractor: McElwee-Courbis Const. Co.**
**Electrical Subcontractor: Snyder and Mackin, Inc.**
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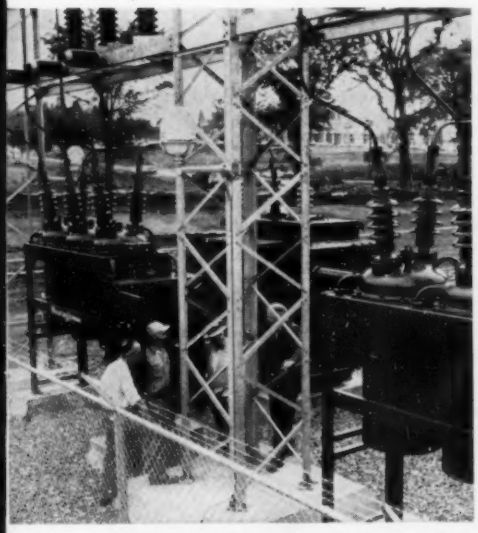

Leo J. Landrigan, Superintendent, Oswego Pumping Station; Richard C. Mansfield, Foreman for Snyder and Mackin, Electrical Contractors; Kenneth D. Jensen; and Charles T. Hansen, Westinghouse Sales Engineer, at outdoor substation which serves new Oswego pumping facility. Two Westinghouse 2000-kva power transformers and two Westinghouse 34.5-kv oil circuit breakers are included in this substation.

Main floor view in pumping station shows four Westinghouse vertical synchronous pump motors with the glass enclosed control room in background. The mezzanine floor above is occupied by Westinghouse 2300-v, heavy-duty, metal-clad switchgear, using Type DH air circuit breakers.

Another view of main floor shows reverse side of control room and, on the mezzanine, Westinghouse double-ended control power center. Floor openings in foreground, not shown, have been provided for the installation of four additional raw water pumping units when filter plant is added.

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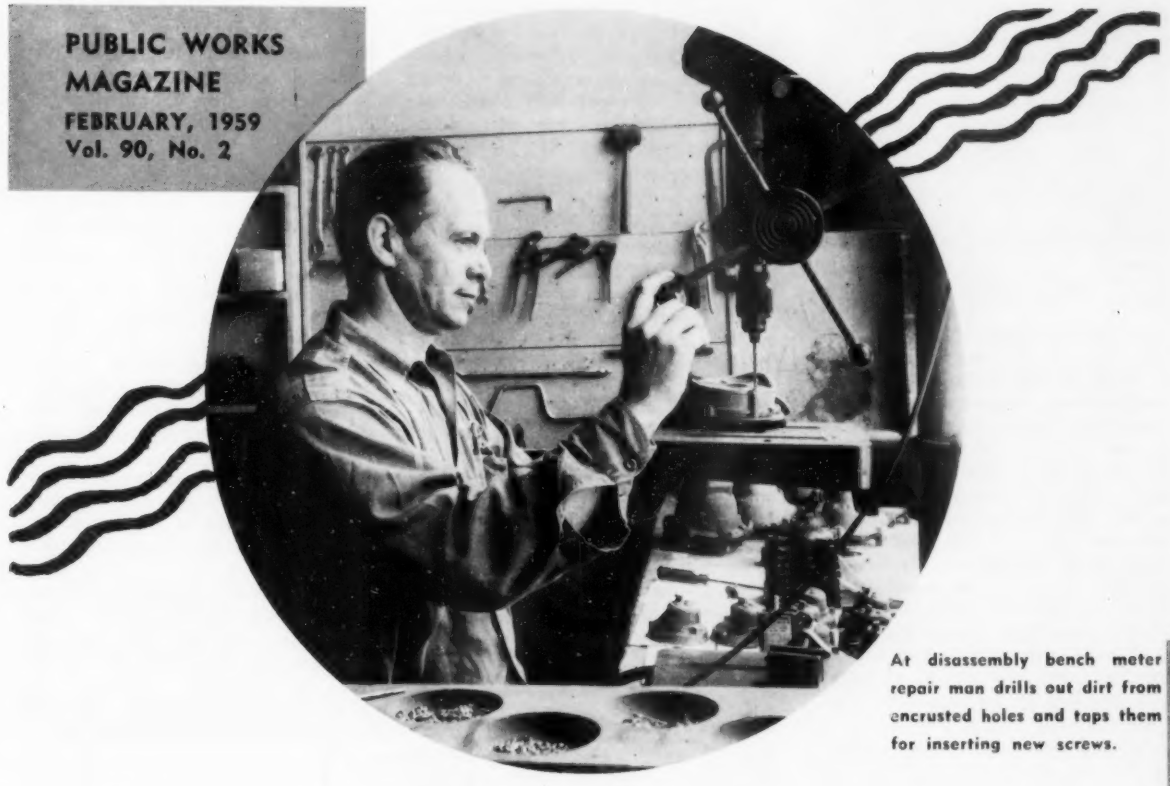
FEBRUARY, 1959
Vol. 90, No. 2



At disassembly bench meter repair man drills out dirt from encrusted holes and taps them for inserting new screws.

# How to PLAN a WATER METER MAINTENANCE SHOP

**BERNARD LAST,**
Chief Engineer,
Uniontown Plant,
Rockwell Manufacturing Co.,
Uniontown, Pennsylvania

EACH YEAR, throughout the country, water works men are faced with the task of laying out a new meter testing shop or improving the arrangements of an old one. Careful study and planning are justified by the many advantages to be gained from a modern, efficient shop. This article will describe the necessary facilities for two "ideal" water meter maintenance shops—one for a small town and one for a medium-sized town.

While this may not present the perfect solution to your town's problem—numerous conditions can affect the size, equipment and layout of the shop—the models described are the "optimum" shops, under normal conditions, for maximum efficiency and economy.

In planning the layout and equipment for your own meter shop some or all of the following factors must be borne in mind:

1.) Number of makes and types of meters used, which affects the size of repair part stocks and the storage space for the parts.

2.) Local water quality, which determines the extent of corrosion, liming or encrustment and wear.

3.) Location and type of meter settings, which control the condition of the meter register and the outside of the casing. Freezeups are a problem in some places and in other localities, condensate and ground water.

4.) In this era of rapid growth, facilities larger than really required at the time of first occupancy are usually necessary. All planning should consider future needs.

In the two shops described here, three factors have especially been taken into account—factors which are most important in receiving maximum efficiency from your water meter maintenance shop. They are: Planning with regard to materials handling; providing modern and sufficient equipment; and considering the needs of the workmen. A meter shop layout planned in accordance with these principles can definitely save time as well as labor. The planned savings of time and labor means money savings with peak efficiency.

In any size meter repair shop the comfort and health of the em-

ployees should be given much consideration. Adequate light sources, preferably daylight or fluorescent; proper ventilation facilities; central heating units; soft rubber mats in working areas; and a ceiling covered with 1-inch acoustic tile to reduce the noise from the numerous repair operations should be provided. These facilities for the workman's comfort will have good effects on the general morale and reflect in the quality and quantity of work produced.

While the ideal work flow in a meter repair shop is fairly standard —receiving and recording, washing, sandblasting, disassembly, cleaning, check for worn parts, reassembly, testing, sealing and painting—steps should be taken fully to utilize labor in a continuous flow pattern.

The very nature of this meter movement suggests the necessity of good material handling practices to simplify as much as possible, the physical work involved. This leads to the following recommendations:

1) Locate the meter shop on the ground floor, eliminating elevators and speeding up the supply problem.

2) Arrange for a loading dock near the door of the meter shop, shortening the supply problem.

3) Maintain a work table arrangement to assure clear vision without glare. Remember, good operation in a meter shop depends upon the workmen being able to see what they are repairing, inspecting or testing.

4) Provide for hot and cold running water. Washing meter parts with water and soap is the most harmless method in use and is sufficient for many parts. Hot water is a "must", especially in cold weather.

5) Locate a motor-driven buffer with fine wire bristles near repair benches. It is important to have this machine within a very few steps of the repairman to avoid continual walking. Equip the buffer with a dust collector or exhaust to reduce the dust hazard.

6) Provide equipment for washing the exterior of dirty meters at the start of the processing cycle. This will assure a much cleaner meter shop.

7) Make compressed air hoses available to both the repairman and the meter tester.

8) Provide storage space for both incoming and outgoing meters near the door. Here they can be easily counted and readily moved in or out.

9) Equip the shop with carts or rolling racks to be used for moving meters from one station to another and for storing. It is desirable to provide facilities for hanging meters onto the rack in an inverted position with hooks to facilitate their removal for examination. Dock facilities should be arranged so that an entire rack filled with meters can be rolled alongside a truck for loading thus eliminating one further handling operation. The benefits from this mobility cannot be underestimated.

## The Medium-Sized Town

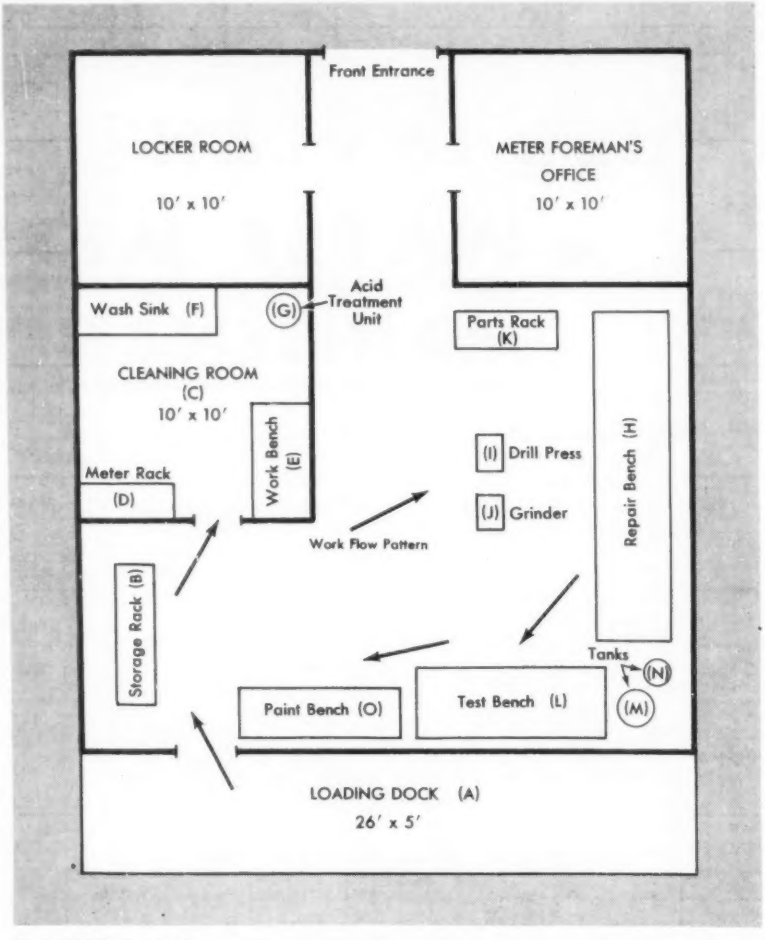
Our model medium-sized town has a population of around 50,000 with approximately 10,000 meters in use. It is a growing town, so the new meter repair shop has been designed to repair 15 meters per day. Our building is one story, 780 square feet with 12-ft. high rooms and has a building-long unloading and loading dock in the rear. The locker room and meter foreman's office occupy 200 square feet of the shop. Repair benches, testing facilities, storage bins, etc., take up the balance of the building.

Incoming meters are unloaded (see Figure 1), checked into the shop and placed in the steel storage rack (B) which stores meters up to the 2-inch size. Before they are moved to the repair benches, they are taken apart in the cleaning room (C).

The repair section is equipped with a repair bench (H), a ½-in. drill press, and a combination grinder and buffer with a built-in dust collector and filter. A meter repair parts storage rack with steel storage shelves is handy to the repair area.

A 2 x 7-foot paint bench (O) is provided. Meters are painted with bronze, dull gold or aluminum depending on the manufacturer's original color.

In addition to the meter shop foreman, our "model" maintenance shop has two maintenance men and one full-time and one part-time laborer.




● **FIGURE 1. Medium-sized meter maintenance shop fits into a 26′ x 35′ building.**

For ideal efficiency it is recommended that the repair shop be located next to the service facilities and field offices.

**Cleaning Room.** There is a difference of opinion regarding the use of acid to clean meter parts. While the current trend is toward airless blast machines, for this paper we will assume the use of an acid-bath (which may be essential if the water supplied in the town attacks the metal in the meter measuring chambers to any great degree).

The cleaning room designed here has one acid treatment unit consisting of one 20-gallon, 18 x 27-inch earthen jar for the acid, an 18 x 20-inch porcelain sink and a 20-gallon jar for neutralizer. The unit is mounted on a structural steel frame. The jars and sink are connected at the bottom with acidproof rubber pipe and fittings for draining acid, neutralizer or wash water. The spent acid is drawn off in a rubber basket, transferred to an acidproof container and spread on the ground at a location that will not cause contamination.

The acid jars are covered with an acidproof hood, made of asbestos-cement board, connected at the top to a suction fan, which carries off the fumes. The room should be supplied with a separate ventilator through the roof.

Acid cleaners are made up of equal parts nitric or muriatic acid with added water, or one of the several proprietary cleaning agents on the market is used.

The meter parts to be treated are placed in rubber-covered steel baskets which can handle 50-75 pounds of parts at one time. To handle this load a small chain block suspended from a standard, light sliding-door track and trolley has been provided. The baskets can be moved in and out of the acid or cleaning compound, the sink and the neutralizer jar with no danger to the repairman.

Other cleaning room facilities include a metal rack, a 6-ft. work bench and a wash sink. Tools and equipment used include: a 6-in. screwdriver, 3-in. set screwdriver, adjustable open-end wrench, T-handle stuffing box and lock nut wrench, machinist or special meter vise, power driven wire wheel brush and wire bristle handbrush.

**Repair Bench.** The repair bench, furnished with a compressed air hose is 36 inches wide, 14 feet long and three feet high. The base is of structural steel, with provision for adjusting the height of the bench to suit the individual repairman, and the deck is constructed of 12-gage stainless steel. The bench is fitted with an adjustable stainless steel jack to hold ⅝, ¾ and 1-inch meters during repairs. Also provided are two sections of standard steel shelving, partitioned into small compartments for meter repair parts and tools, and an anvil vise used when numbering meters, repairing and installing meter lids. Naturally, a repair bench may be constructed in many different ways, but the main idea is to provide a place for the parts and tools and to see to it that the bench does not become so littered that it interferes with the repairmen.

● **METER components are placed in the sand blaster to remove encrustations.**

● **STORAGE space for meters near the door facilitates in-and-out movements.**

Tools for the repair bench include: Hammer; wooden or leather mallet; screwdrivers; wrenches; pliers; metal scrapers; wire brushes; a pipe wrench (12-in. or 16-in.); medium size needlenose pliers; a small size brazing torch; one set of metal stamps; a complete set of line reamers; and an electric soldering iron.

**Testing Facilities.** The meter-testing equipment includes one 8-ft. test bench (L in Fig. 1) equipped with a manually operated clamping mechanism—and able to test four meters at a time; a rate-of-flow indicator graduated to register flows from 0.25 to 34 gpm; and 1 cu. ft./10 gal.—10 cu. ft./100 gal. (M & N) calibrated tanks. It is hard to realize that in many existing shops, the testing equipment is capable of testing only one meter at a time or, at best, two small meters. There is no excuse for such practice—the minimum size of testing bench should have a capacity of at least four meters at one time even though this capacity is not always used to its fullest extent. The additional investment in increased testing capacity will pay for itself through decreased unit testing costs.

The test bench should handle all domestic size meters up to 1-in. inclusive which accounts for 99 percent of the testing. An adapter can be used or acquired for testing up to 2-in. meters. This accessory can be attached to the test bench and permits the testing of larger meters conveniently with a minimum investment.

The calibrated tanks provide a means to check the meter being tested against the actual volume. Drainage piping for the tanks should be of sufficient size to empty the tanks quickly.

Since the economics in this case do not warrant facilities for large meters that may be tested on location, no facilities have been provided. When large meters are tested and found faulty the "works" can easily be brought in, repaired and replaced.

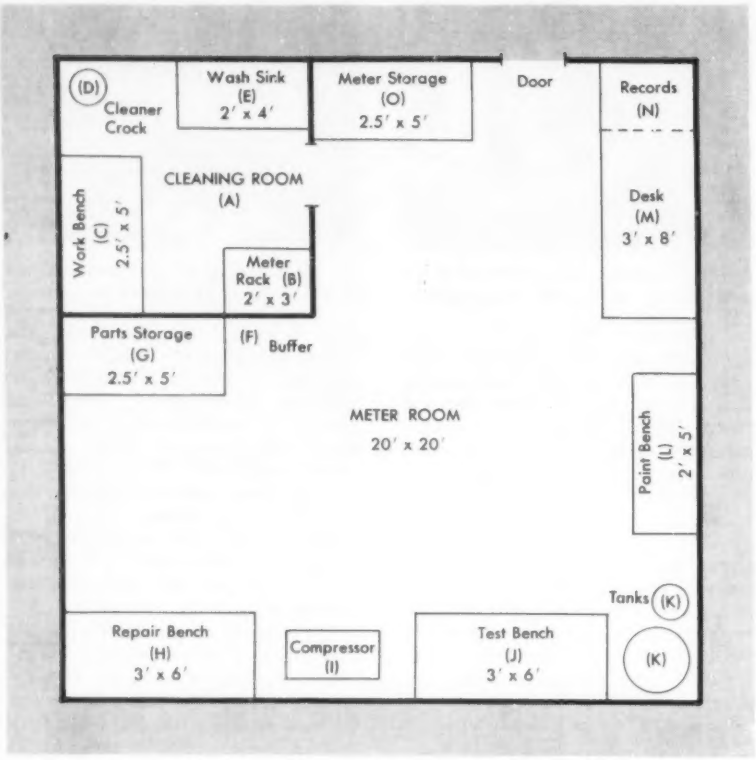
## The Small Town

Even though the town may be small—in the 10,000 to 20,000 class—it does not pay to disregard the planning and materials handling suggestion made at the beginning of this article. These suggestions are important and necessary for any size meter repair shop.

While in this size town it is not likely that more than 4 or 5 meters will be repaired per day, the shop should be designed to handle up to 10 meters per day. Here is where the "eye to the future" is important, for it is not unusual for a town of 10,000 to grow to 20,000 or the town of 20,000 to grow to 30,000 or more in less than 10 years.

For the small town approximately 400 square feet of space is sufficient for meter repairs. This shop can either be a small 20 x 20-ft. building or a large room in the field offices. Because of the recommendation for proximity to the field offices, the lockers and wash room facilities can be eliminated from our shop layout for the small town. Also, no office is needed—a desk and cabinet for record storage will suffice.

Incoming meters are unloaded and brought into the cleaning room (A in Fig. 2) for washing, sandblasting, buffing, acid cleaning if necessary, and disassembly. They then move to the repair bench (H), test-




● **FIGURE 2. Proposed layout for small meter repair shop provides all facilities needed for testing and maintenance. Shop is designed to handle ten meters per day.**

ing area (J), back to the repair bench for reassembly, to the paint bench (L) and then to the meter rack (B) to await an out-shipment.

Because only small quantities of meters are painted during a work week in the small town this shop does not have spraying facilities. Paints can be purchased in powder form with suitable mixing liquid, or they can be purchased already mixed. Our small shop would be ideally run with two men.

**Disassembly and Cleaning.** Even in the small shop the area for the performance of this work should be segregated from the main repair area. During the cleaning operations a great deal of dirt, dampness and acid fumes can accumulate with obvious disadvantages to the cleanliness of the shop and the discomfort of the workmen.

The cleaning room includes a meter rack for storage, a work bench for disassembly, a cleaner crock and wash sink.

In the cleaning room, the following tools and equipment are used: a 6-in. screwdriver, 3-in. set screwdriver, adjustable open-end wrench, T-handle stuffing box and lock nut wrench, machinist or special meter vise, power driven wire wheel brush and wire bristle handbrush. The requirements for cleaning solutions are the same as for the medium-sized town.

Acid cleaners must be kept in a stoneware crock or rubber lined vessel large enough, approximately 12-gal. size, to admit a three-gallon stoneware or monel dipping basket. A hood with exhaust fan should be installed over the container to carry fumes outdoors. Other acid handling equipment necessary are a carboy cradle or acid siphon pump, rubber gloves, apron and overshoes.

**Repair Bench.** A 6-ft. repair bench equipped with a small air compressor, storage drawers for meter parts and tools, and a medium duty vise is ideal for the small shop. This substantial workbench should include such tools as a hammer, wooden or leather mallet, screwdrivers, wrenches, pliers, files, metal scrapers, wire brushes, one pipe wrench (12-in. or 16-in.), medium size needlenose pliers, one set of metal stamps, a complete set of line reamers, an electric soldering iron, wrenches for $\frac{5}{8}$, $\frac{3}{4}$ and 1-in. meters and an electric hand drill.

**Testing Facilities.** The best facilities (J) include a 6-ft. test bench—with a manually operated clamping mechanism—to handle two meters at a time and all domestic size meters up to 1-in. inclusive. Other facilities needed are a pressure gauge, a rate-of-flow indicator, an adapter for testing $1\frac{1}{4}$-in., $1\frac{1}{2}$-in. and 2-in. meters, and a 1-cu. ft. and 10-cu. ft. calibrated tank (or 10 and 100-gallon prover tanks). Naturally the calibration of tanks used for testing depends on whether the meters record in gallons or cubic feet. In some shops it may be necessary to have the tanks calibrated in both cubic feet and gallons.

There are no large-meter testing facilities since in most small towns this work is done in the field.

**Conclusion.** In the design of the facilities for the repair and testing of water meters, in both plants, every effort has been made to follow the principles of efficient material handling, to use proper equipment and tools and to insure the health, safety and comfort of the workmen. Regardless of the particular design you use, the repair shop you construct will be efficient and economical if the three basic principles above are followed.

● **THIS IS the assembly bench in the meter repair shop of the South Huntingdon Water District. The drawers contain stock components for various sizes of meters.**

# THE AEROSOL SPECTROMETER

## . . . A NEW INSTRUMENT FOR THE ANALYSIS OF AIR-BORNE PARTICLES IN THE SUBMICRON RANGE

**DR. ALEXANDER GOETZ,**

**California Institute of Technology,**

**Pasadena, California**

IN RECENT years it has become increasingly apparent that the aerosols represent a significant factor in the highly complex problems of air pollution. The term "aerosol" comprises the enormous multiplicity of air-borne particles (liquid or solid), which — unlike dusts and most smokes—do not settle out but remain suspended for long periods of time. Because of their extremely small sizes, there are difficulties in their study, and our knowledge about them is limited.

The public health importance of the aerosols is that traces of gaseous irritants may be intensified if they associate or react with the aerosol particles released into the atmosphere. Several investigators have recently supplied evidence that such synergistic intensification of gaseous irritants in minute concentration can be caused by aerosols of salt, oils, etc., which are by themselves quite inactive. Probably a much higher irritant concentration forms on a sensitive surface by impaction than the relatively rare "free" gas molecules can effect at high dilutions.

### *Need for New Methods*

Determining the constitution of, and the reaction within such atmospheric suspensions is seriously limited by techniques for removing particles from their air-borne state. It is necessary to precipitate them by methods which interfere least with the physical and chemical nature of the particles. In most filtration and impingement methods, the surface of the particle is exposed, after its retention, to the shearing action of the passing gas stream. This shear can upset the loose association of gases with the particle surface to a considerable extent.

Equally important is the requirement for a concentration method which reveals the size and mass distribution among the particles. It is easily seen that analytic information about the nature and mass relation of the aerosol constituents can be quite misleading if the presence of a few particles of micron size obscures the nature of thousands in the submicron class. The latter, however, have for the same mass not only a surface area at least 100-times larger for interaction with the molecules of the suspending gas but also about 10-times greater mobility due to the Brownian movement. Hence an aerosol substance occurring as 0.1 micron particles becomes about ten thousand times more available for contact with surfaces such as those of the eye or the respiratory system than the equivalent in weight of 1 micron particles. As carriers of gaseous irritants, the small size particles would also be about 100 times more effective, information which the chemical or spectroscopic analysis alone cannot reveal.

Theoretical considerations of this sort, combined with the practical experience that atmospheric irritation and toxicity concur with the high aerosol levels have led the California Institute of Technology since 1955 to develop methods of precipitation and concentration of natural and artificial aerosols in the submicron range. This program was initially supported by the Air Pollution Foundation, Los Angeles, and subsequently by the United States Public Health Service. The instrument described here resulted from this effort.

### *Principles Involved*

The working principle of the "Aerosol Spectrometer" is based upon the well known application of a large centrifugal field to a continuous flow of the gaseous suspension under test. Precipitation by gravitational forces, if suitably applied, should affect the particle constitution least and should cause the segregation of even the smallest particles as long as the air flow remains free of turbulence. Obviously, this latter condition of nearly laminar flow conflicts with the condition for the very high velocities required for generating centrifugal fields of 10 to 40 thousand times gravity necessary for precipitating particles in the range less than 0.1 micron.

● **FIGURE 1. The Aerosol Spectrometer, partly disassembled, and foils are shown at the right. Instrument at left is for checking motor speed, voltage and current.**

This dilemma has been overcome by arranging a channel guiding the air to flow in the form of a helix on the surface of a conical rotor which can spin at about 25,000 rpm. The channel travels thus with the air flow which in turn can move slowly relative to the walls and thus remain laminar, while it moves at a high absolute velocity which causes the centrifugal field.

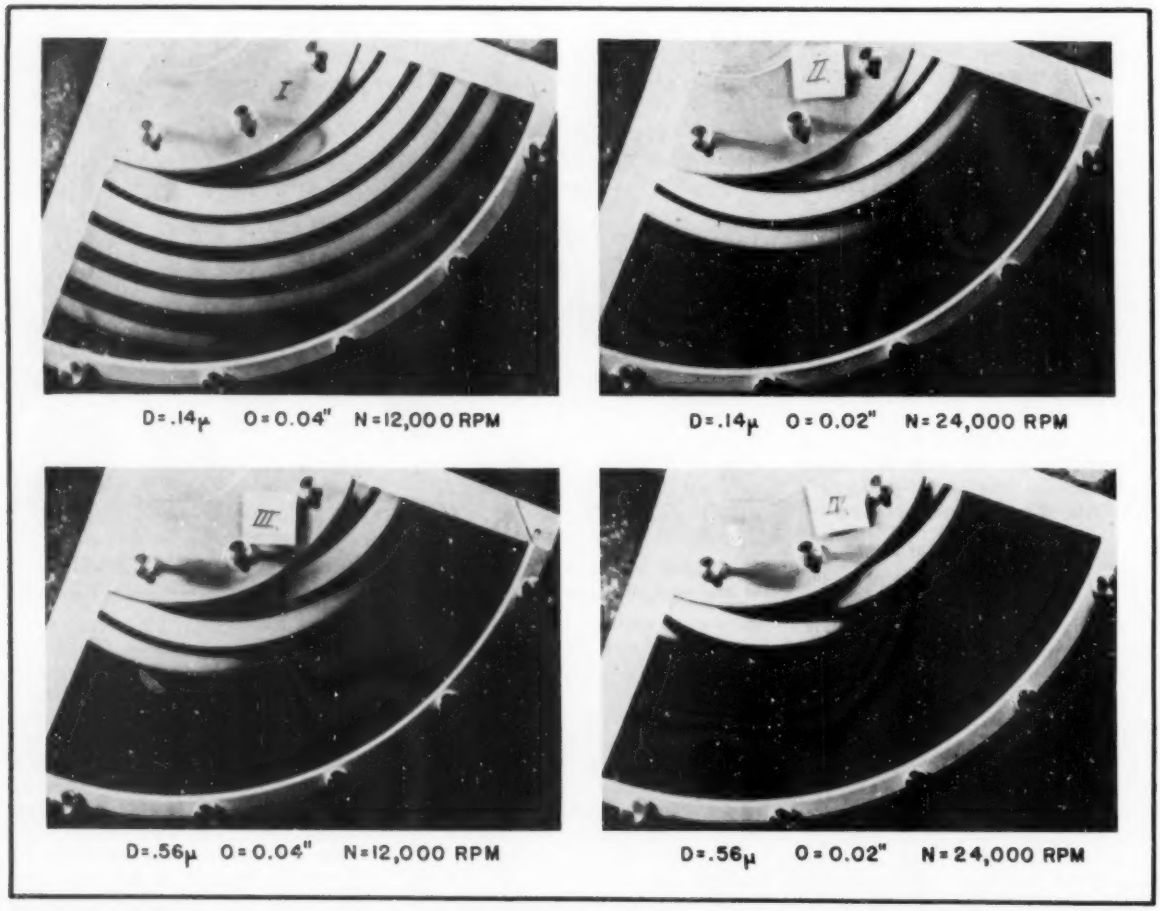
Hence there are three velocity components involved. One component occurs in a radial direction across the flow in the channel toward the outer channel wall. This would be realized by an observer travelling with the air flow and watching the motion of a suspended particle. This velocity depends on the size and mass of the particle: the large particles will reach the outer channel wall earlier than the smaller. In this manner a size classification is obtained. For the smallest size class this speed is about 0.5 in. per sec., i.e. so small that the shearing effect by the air on the particle should be minimal. The second velocity component is the flow velocity of the air, as seen by an observer placed on the channel wall. This velocity amounts to 2 to 3 ft. per sec. The third component is the (absolute) velocity of the channel as part of the rotor and amounts to about 300 fps at the wide end of the cone. Accordingly the ratio between these speeds is about 1:100:10,000.

A peculiar advantage of this construction is the pumping action of the helix channel, making a separate pump unnecessary. The flow is controlled by restricting its cross section at the exit with exchangeable jets similar to those used in carburetors. As this impeller action depends on the speed of rotation, different jets have to be used to control the flow at different speeds.

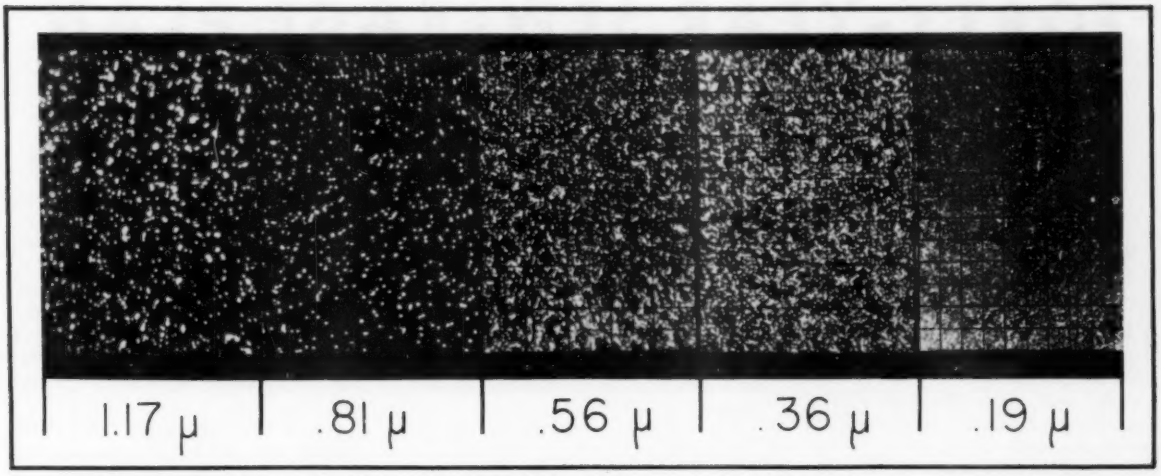
The overall channel length and the flow rate through it determine the time of exposure to the centrifugal field, or the time available to a particle to reach the outer channel wall. For a channel of 16 inches this amounts to 0.4 to 1.5 sec. depending on the operating conditions. The air volume passes the channel at a rate of 4 to 8 liters per minute.

The commercial model of the Aerosol Spectrometer* is shown in Fig. 1. The rotor is a cone which carries on its outer surface 2½ turns of a double helix, forming three of four walls of two independent helical channels. These channels are sealed by an exactly fitting conical cup, the interior of which is lined with a removable foil whereon the particles are deposited.

*Instrument Development & Manufacturing Co., 3018 East Foothill Blvd., Pasadena 8, California.




● **FIGURE 2. Results of spectrometer operation. (I) shows a case where the centrifugal force was insufficient to eliminate all particles, hence the deposits cover the entire length of the channel. In (II) the same aerosol is entirely eliminated after passage of the first third of the channel for the rotor ran at twice the speed of (I) and thus supplied a four-fold centrifugal force. For the same reason the larger diameter aerosol is distributed over a greater range in (III) than in (IV). After calibration of the instrument, the particle size of an aerosol can be derived from the length of the deposit range on the foil.**




● **FIGURE 3. Particle size distribution is determined by making counts in definite field areas under a microscope.**

The operation of the spectrometer is easily seen from Fig. 2, representing photos of 4 foils after exposure to artificial monodisperse aerosols of 0.14μ and 0.56μ diameter latex particles, deposited under two different operating conditions. The foils consisted in this case of black glossy paper upon which the aerosol was deposited, forming two sets of spiral tracks on the part of the foil which was the outer wall of the channels during the run.

The deposit can be examined by the optical (darkfield) microscope and counted for a definite field area. As shown in Fig. 3, a series of such counts along the deposit make it possible to determine size distribution in complex aerosols.

Similarly foils of analytical filter paper can be divided after exposure by cutting along a predetermined pattern and submitting each division to chemical or chromatographic analyses, to establish the distribution of the chemical constituents in different size classes. In this manner the danger of obscuration of the small by the presence of large size fractions is completely eliminated. It is also possible to impregnate the foil initially with specific indicators in order to determine the size of a particular constituent. Finally the outflowing air from which the particles have been removed can be tested for its toxic or irritating capacity to determine whether or not the irritant is part of the aerosol or a gaseous constituent. According to the above this procedure does not give necessarily the same results as filtration.

In this manner it could be shown that eye irritation, caused by irradiated auto exhaust, can be largely eliminated by the precipitation of particle sizes down to 0.15μ whereas the plant damage, caused by such agents, was not found to decrease in a particular set of tests.

The instrument promises also to lead to a more exact evaluation of the performance of air filters, precipitators and similar devices than possible heretofore.

Although the aerosol spectrometer has only recently become generally available as a standardized model, it has already proven useful in a number of applications and promises to fill serious gaps in our knowledge about the role and constitution of aerosols in atmospheric pollution.

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# NEW ADDITIONS TRIPLE PUMPING CAPACITY ON LONGEST, LARGEST, U. S. WATER SUPPLY LINE

Recent additions to the five pumping stations of the Metropolitan Water District of Southern California will triple the original installed pumping capacity—from 600 to 1800 cu. ft. per second.

To reach the southern California area, water is carried 242 miles across the state of California, and is lifted over mountain barriers by five pumping stations. At one of these, the Iron Mountain station located in San Bernardino county, some of the largest pumping equipment made by Allis-Chalmers, Milwaukee, Wis., is installed. In 1939, Allis-Chalmers shipped the first three pumps and motors to the Iron Mountain station. Now a total of nine A-C pumps and motors are in operation there. Pumps are 48-in. type SSV, 300 rpm, have a capacity of 90,000 gpm at 146 ft. head, and are driven by Allis-Chalmers 4300-hp, 6900-volt, 300-rpm vertical synchronous motors for coupled service. The motors are enclosed and have air-to-water heat exchangers. Exciters and other auxiliary equipment included with the units were also supplied by Allis-Chalmers. Power to run the pumping motors is furnished from Hoover dam.

# FORTY-YEAR SEWERAGE PLAN FOR A METROPOLITAN COUNTY

**KENNETH A. McCORD,**
**Associate,**
**Whitman, Requardt and Associates,**
**Baltimore, Maryland**

THE HOWARD County, Maryland, Master Plan Sewerage Report, just completed by Whitman, Requardt and Associates, Baltimore consulting engineers, may well be one of the most comprehensive sewerage reports ever made for a county commission. Where most studies of this type are limited to a single metropolitan area, the Howard County Report is county-wide. The engineers took into consideration the anticipated sewerage needs of a 253-square-mile area during the next 40 years, and the resulting recommended construction is to be fully coordinated with the adjoining facilities and sewerage plans of Baltimore County, Baltimore City, Anne Arundel County, and the Washington Suburban Sanitary Commission.

The Howard County Metropolitan Commission initiated the study because of the rapid rate of increase in county development and population. During the 40-year period covered by the report, the county population is expected to top 176,000; at present it is less than 40,000.

The system will extend completely across the county and will include about 140 miles of piping and 17 pumping stations. The design of the pipe structures and pumping facilities is based on an average daily flow of 100 gal. per cap. and a maximum daily peak of 200 gal. per cap.

No specific allowances are made for industrial wastes. The present industries in Howard County are not large water users and therefore do not present a major problem in providing adequate sewerage capacity. If a large industrial water user does desire to locate in Howard County in the future, the affected portion of the proposed sewerage system would be reviewed with respect to the quantity and quality of the anticipated industrial waste. Since the entire project is designed for construction in stages, such a future review is quite feasible.

Although the complete sewerage system will not be constructed initially, the communities of Savage, Elkridge and Ellicott City are in immediate need of sewerage facilities. These communities can be adequately served by the limited construction which will be the first phase of the program. These initial facilities will cost about $2,655 million and can be completed in two years.

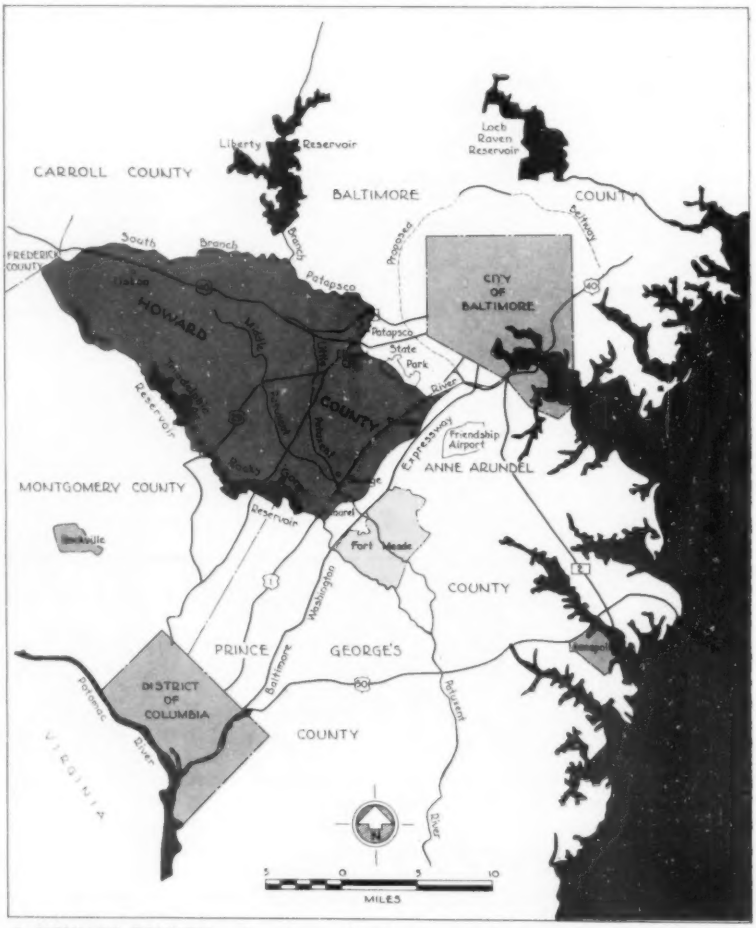
The project is composed of five main systems:

*The County Line Interceptor System* will extend from the County Line Pumping Station on the Little Patuxent River at the Howard County line in an easterly direction and generally parallel to the county line to the Patapsco River. This interceptor system will include the County Line Pumping Station, the County Line Force Main and the County Line Interceptor Sewer.

*The Patapsco Interceptor Sewer* will extend from the confluence of Deep Run and the Patapsco River in Elkridge upstream to the confluence of the Patapsco River and Sucker Brand north of Ellicott City. This interceptor will be a gravity sewer.

*The Little Patuxent Interceptor System* will consist of two sections. The Little Patuxent Interceptor I System will serve that portion of the Little Patuxent area upstream from Oakland Mills. The Little Patuxent Interceptor II will serve the remaining portion of the Little Patuxent drainage area.

*The Middle Patuxent Interceptor System* will extend from the con-




● **HOWARD COUNTY and environs, showing the principal waterways and reservoirs.**

● **MAP SHOWS comprehensive sewerage system planned for Howard County. There are to be five principal interceptors.**

fluence of the Middle Patuxent and Little Patuxent Rivers upstream to the extreme northwest portion of the drainage area in the vicinity of U. S. Route 40.

*The Patuxent Interceptor System* will consist of two sections. The Patuxent Interceptor I will serve that portion of the Patuxent drainage area from the Howard-Anne Arundel line upstream to the dam of the Rocky Gorge Reservoir. The Patuxent Interceptor II system will serve that portion of the Patuxent drainage area upstream from the Tridelphia Reservoir.

The estimated costs, including land costs and all contingencies, of the ultimate sewerage system to serve the entire county are: County Line Interceptor, $3 million; Patapsco, $3.5 million; Little Patuxent, $4.3 million; Middle Patuxent, $5.7 million; and Patuxent, $3.5 million.

To reduce the capital expenditures to an amount within the present financial ability of Howard County for satisfying the present needs of Savage, Elkridge and Ellicott City, the report recommends that certain temporary measures be taken and that certain pipe lines in the initial construction program be undersized. If these measures are undertaken, the total estimated cost for the sewerage system will be increased to $20,850,000. In addition to the cost of construction within the political boundaries of Howard County, the report estimates that an additional $3.5 million will be spent to provide capacity for Howard County's flows in facilities of adjoining agencies. The total cost to Howard County is therefore estimated to be $24,350,000.

The report tentatively recommends that Howard County look to the collection and drainage of all its sewage into the sewerage system of Baltimore County for conveyance to the City of Baltimore for disposal except for a small amount originating in the Patuxent drainage area which could be discharged into the sewerage system of the Washington Suburban Sanitary Commission for disposal at the Commission's new Laurel Sewage Treatment Plant. Since the report was submitted, however, a supplementary study has been initiated to determine the sewerage needs of adjacent areas, including that of Fort George Meade in Anne Arundel County. Participation by Howard County with the other governmental agencies in the area may result in a more satisfactory method of disposing of sewage originating within Howard County.

### *Financing*

The comprehensive sewerage system to serve all of Howard County and estimated to cost $24,350,000 can be financed, maintained and operated over the projected 40-year expansion period through the issuance of $6 million of general obligation bonds during the first ten years of the program. In addition to the bond

issue, Whitman, Requardt and Associates recommends the following charges which, at the projected rate of growth, would provide sufficient funds for a pay-as-you-go construction program:

1) An ad valorem tax within the sub-district served, at the rate of 15¢ per $100 of assessed valuation, to be levied for a period not exceeding 30 years on any improved property;

2) An interceptor connection charge of $250 per house against new construction which is non-returnable, not applying to structures which have been completed and for which general taxes have been levied during 1958;

3) A minimum sewer service charge of $5 per quarter per residential customer or 100 percent of the actual water bill, whichever is the larger, of which 50 percent of the charge would be used to finance the construction work and the remaining 50 percent would be used for the maintenance and operation of the system.

The report recommends that the Commission pay for the construction of local collecting sewers through bond issues and that the bond issues be serviced by the levying of a front-foot benefit charge against the actual properties fronting on the collecting sewers.

The immediate construction of the required facilities to serve Savage, Elkridge and Ellicott City can be financed through issuance of general obligation bonds totalling $2 million and the levying of the foregoing charges in existing sub-districts. In addition to the construction of the comprehensive sewerage system, the development of the county will necessitate the construction of collecting sewers to serve individual customers, and the extension of existing water distribution systems. Consideration of these costs is included in the engineer's determination of the over-all ability of the county to finance the total sewerage system.

By law, the ratio of outstanding bonded indebtedness within sub-districts over which the Metropolitan Commission has jurisdiction is limited to 20 percent of the assessed valuation of the sub-districts. If the recommended method of financing the sewerage system is adopted by the county, the maximum ratio of bonded indebtedness to the assessed valuation of the areas served by the comprehensive sewerage system, including the cost of constructing collecting sewers and water distribution mains, is not expected to exceed 11.3 percent.

● PRECAST prestressed beam being set in place by crane.

# PRECAST, PRESTRESSED CONCRETE BRIDGES FOR COUNTY ROADS

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**Engineer-Manager,**
**Ottawa County,**
**Grand Haven, Michigan**

THE OTTAWA County Road Commission, early in 1956, reviewed the design standard of the bridges it had been constructing over its county primary roads. The purpose of this review was to determine if their present design would meet the following qualifications:

1) The bridges shall be of simple design; 2) they shall provide low maintenance cost for economy over a long period of time; 3) they shall be easy to construct; 4) they shall be readily adaptable to future widening; 5) they shall be designed so that the stream can be lowered without affecting its stability; and 6) they shall meet present and future traffic needs.

Reviewing the construction materials that were available, it was decided in order to meet the above qualifications, that a bridge of the following design would come closer to meeting all the qualifications than any other design used previously by the Road Commission.

The substructure units would be composed of an abutment wall two feet in thickness supported on a single row of piling; these piling to be driven to a minimum bearing of twenty tons and to a sufficient depth so that, if the stream bed is lowered in order to increase the flow of the stream, such as happens in the improvement of drainage districts, the supporting piling will not be undermined. The thickness of the wall was established at two feet in order to permit casting in place without difficulty.

The superstructure would be of precast, prestressed concrete beams

**Table 1—Design and Cost Data on the Six Bridges Built in Ottawa County**

| | *Rush Creek 12th Avenue* | *East Branch Rush Creek Port Shelton St.* | *Sand Creek Luce Street* | *Bass River Bass Drive* | *Lloyd Bayou Leonard Street* | *Kampen Struik Drain Adams Street* |
|---|---|---|---|---|---|---|
| | *1956* | *1956* | *1956* | *1957* | *1957* | *1957* |
| Design Load | H15-44 | H15-44 | H15-44 | H20-44 | H20-44 | H20-44 |
| Width | 33 ft. | 33 ft. | 30 ft. | 30 ft. | 30 ft. | 33 ft. |
| Overall Length | 36 ft. | 64 ft. | 2 @ 38 ft. | 2 @ 32 ft. | 30 ft. | 36 ft. |
| Clear Span Length | 32 ft. | 60 ft. | 2 @ 35 ft. | 2 @ 29 ft. | 26 ft. | 32 ft. |
| Depth of Beam | 17 inches | 27 inches | 17 inches | 17 inches | 17 inches | 17 inches |
| Abutment Height (to bridge seat) | 7′—9″ | 6′—0″ | 9′—8″ | 8′—7″ | 12′—0″ | 12′—0″ |
| Approximate Weight Per Beam | 8 tons | 19 tons | 9 tons | 7 tons | 7 tons | 8 tons |
| **COST:** | | | | | | |
| Substructure | $ 8,556.08 | $ 9,003.38 | $10,939.49 | $14,944.92 | $12,298.29 | $13,845.10 |
| Deck Beams (in place) | 5,639.00 | 14,128.00 | 11,186.21 | 6,998.35 | 4,085.00 | 5,935.82 |
| Labor, Equipment and Materials | 764.44 | 1,881.06 | 2,652.39 | 1,163.93 | 1,130.39 | 886.75 |
| Engineering | 521.86 | 675.40 | 1,080.54 | 695.34 | 547.25 | 978.91 |
| Totals | $15,481.38 | $25,687.84 | $25,858.63 | $23,802.54 | $18,060.93 | $21,646.58 |
| Cost Per sq. ft. of Deck | 13.03 | 12.16 | 11.34 | 12.40 | 20.07 | 18.22 |

of the conventional square patented beam design to meet AASHO H15-44 or H20-44 loading. The use of precast, prestressed concrete beams have the following advantages:

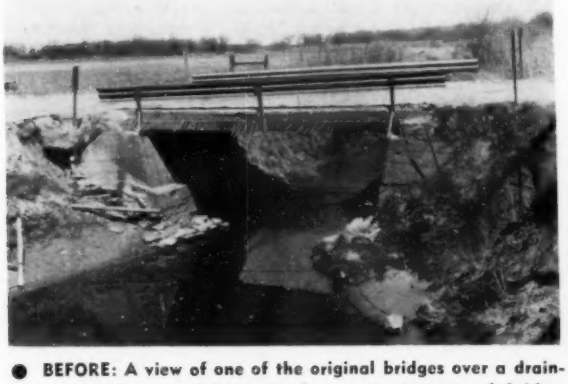
There is no painting required; the beams are durable; and it is an easy type of superstructure to widen. The elevations from the underside of the beam to the roadway are of the least beam depth as opposed to other methods of construction, thus affording more area for stream flow. The beams are available up to lengths of approximately 80 feet in our county.

It should be noted that in our county the terrain is flat. The roads are fairly straight, thus facilitating delivery by the manufacturer of the precast, prestressed beams. We are given to understand that, in more rugged terrain or in mountainous or hilly areas, the economical beam length for the manufacturer to deliver is 45 to 50 ft.

For the above reasons, it was determined that for any bridge of a 20 to 60-ft. span, or for multiple spans of these lengths, this type of superstructure would be most economical and would best meet our needs. We would like to add that this superstructure design, as compared with the conventional steel rolled beam with a concrete roadway, is very competitive in cost.

### *Six Bridges Built*

As a result of the study made in early 1956, the Ottawa County Road Commission has to date reconstructed six of its small bridges ranging from 30 to 60-ft. span lengths. In two cases, the structures were of a two-span design with a center pier. We also had an occasion to reconstruct a 20-ft. culvert



● **BEFORE: A view of one of the original bridges over a drainage ditch prior to replacement by a new prestressed bridge.**

● **AFTER: New prestressed bridge has a span of 32 ft., an overall length of 36 ft. and a width of 33 ft. Cost $21,600.**

superstructure. In this particular case, the beam depth of the original structure with its deck was identical to a properly designed precast, prestressed concrete beam, and the replacement of this deck using the precast, prestressed beams worked out very satisfactorily.

The designs of these six structures were based on AASHO design H15-44 loading for roads carrying two hundred to two thousand cars per day with little truck traffic, and on H20-44 for county roads of greater and heavier truck traffic volume. In practice, we found that using the heavy loading in our design did not increase the cost of the structure for certain span lengths because the depth of beams are standardized.

The precast, prestressed concrete beams used for the Ottawa County bridges were cast at the manufacturer's yard.

Previous to pouring the concrete, the tension steel wires were prestressed to approximately 190,000 psi. The maximum allowable psi is greater than 80 percent of its ultimate strength of 240,000 psi. In the case of a short beam length, it is possible for the manufacturer to cast several beams at one time in one set of forms. The concrete that is used must have a minimum compression strength after 28 days of 5,000 psi. Before the steel wires that are under tension can be released, test cylinders of the beam concrete are tested and these must attain a minimum cylinder strength of 4,000 psi.

### *Pouring the Concrete*

The concrete is placed at a temperature of not less than 50° or more than 80°F and as near to 70° as practical. The beams are cured at a temperature between 70° and 145°F until the concrete attains a strength of 4,000 psi as determined by the test cylinders cured in the same manner as the beam.

The workmanship, handling and storage should be of such a nature that no transverse cracks shall develop in the beams, and the end sections also shall be free of cracks. If longitudinal cracks develop, they shall not exceed 3 percent of the beam length and should be properly patched.

The precast, prestressed beam is placed on the substructure so as to give a flat and smooth surface with a tight longitudinal joint. Before the beams are anchored on the bridge seats, the beams are bolted transversely with tie rods through the beams. After the beams are set and tied transversely, anchor dowel holes are drilled into the bridge seat through holes provided in the ends of each beam. After the dowels have been placed, the anchor dowel holes are filled with hot-poured asphalt filler.

After the prestressed concrete beams are firmly set in their final position, the longitudinal joints are thoroughly cleaned and filled with mortar except for the upper portion which is filled with a hot-poured rubber-asphalt type filler.

The construction cost of the six bridges built by the Ottawa County Road Commission in 1956 and 1957 are shown in Table 1. Some of the minimum specifications of these structures are included so that these construction costs will be more realistic.

The Road Commission advertised for bids for these bridges, dividing the substructure and the superstructure into separate contracts. The substructure contract called for the contractor to do the necessary excavation in order to drive the substructure piling and to contruct the abutments and pier complete. The contract for the superstructure called for the contractor or manufacturer to cast the precast, prestressed concrete beams and deliver and set them in place on our substructure units. The Road Commission, with its own forces, completed the longitudinal crack filling, the drilling, and the placing and filling of the anchor bolts for the precast, prestressed beams. Also, we placed the simple guard rail. However, the manufacturer of the beams was required to furnish railing post inserts cast-in-place in the outside beams. The grading and the backfilling were completed by county forces.

The only items that needed painting on completion of the bridge erection were the railing posts. The ribbon guard rail, which is used as bridge railing, is galvanized in order to minimize the need for painting.

No special provisions were needed for the financing of these six county bridges inasmuch as presently the Road Commission, through its Michigan State gas and weight tax return and the Board of Supervisor's appropriation, have been able to do between $350,000 and $400,000 new construction work each year. Thus, the Road Commission was able to budget these six bridge jobs within its construction program.

The bridges, which we have designed, were approved by the Michigan State Highway Department. They would qualify for federal aid if we had decided to use our federal aid for bridge construction purposes.

The results of our bridge construction program using the precast, prestressed concrete beams have proved to be satisfactory and have met the six requirements that we set forth in the opening part of this article.

We might add that it has been our experience that using a straight abutment wall as opposed to turning the wings on the end of these walls has simplified construction. We find that the straight wall adequately supports the backfill behind the abutment. If any erosion may occur at the ends of these walls, we take the broken concrete from the old structure and use it as riprap in back of these corners, which protects from the scouring effects of the stream; and we have not as yet encountered any trouble by this method. We constructed the abutments as one large unit, the slope wall being an integral part of the back wall. It may be more advisable to use separate slope walls to facilitate future superstructure widening. If the structure is superelevated, separate slope walls should be constructed after the beams are in place.

Our experience has proved that the wall thickness of two feet is sufficient width in which to drive our single row of piles with reasonable tolerance, and it provides adequate concrete. With this wall thickness, adequate access to all parts of the wall was provided workmen to do a good job of vibrating the concrete. Thus, the two-foot thick wall is a good compromise for the engineer's design and the contractor's working ability.

● **ROAD-USERS' view of the pre-cast prestressed bridge shown on the preceding page. This 1957 job cost $18.22 per square foot of deck area; design basis is H15-44.**

# A PRIMER ON CITY PLANNING

**HOLLISTER KENT**, Director, Division of City and Regional Planning,

Sargent-Webster-Crenshaw and Folley, Syracuse, New York

INCREASINGLY, the words "planning", "city planner", "master plan" and "urban renewal" crop up at city hall conferences, zoning hearings and in daily headlines. They signify two important developments: awareness of the need for planning the present and future courses of our communities by public officials and private groups alike; and the rapid rise of a new profession, city planning, which specifically trains its practitioners to solve as systematically as possible the problems of growth and development now looming before most of the nation's localities. As a means of highlighting for our readers some points on city planning, Hollister Kent answers these questions on the subject.

*What is city planning?* City planning is the orderly and economical development of physical surroundings that are or will be inhabited by human beings. Substitute for the word "city" village, town, metropolitan area or region, and the definition still applies.

*What do city planners do?* There are two kinds of planners: resident planners who possess an intimate knowledge of the area in which they reside; and planning consultants which includes planners in State and Federal bureaus. Consultants often can bring fresh viewpoints as well as broad experience to planning problems facing either resident planners or municipalities unequipped with planning staffs.

*What is a master plan?* A master plan describes an area's economy, transportation network, and traffic patterns. But its most important part deals with the area's people; who they are, what they earn, where they work, and how they use the area for schools, public utilities, recreation, and other community facilities. In short, a master plan answers these questions about a locality and its citizens: What have we got? What do we want? How do we go about getting it?

*How long does it take to do a master plan?* Depending on the area under study, a master plan takes about two years to complete; one year amassing material and another preparing the plan itself. The third phase, or implementation period calls for legal and administrative action to put the plan into effect.

*What's the procedure for putting a master plan into effect?* Most people recognize the need for planning. The problem is getting it. City administrators and engineers, resident planners and planning boards usually are so taken up with daily jobs that they cannot concentrate on overall planning problems. That's probably the prime reason why consultants exist.

*What is the relationship between city planning and urban renewal?* Before I answer this directly, let me explain one thing: urban growth and decay occur constantly. Whether or not you have a master plan in effect, your city will continue to change, expanding or disintegrating, but it won't stand still. This continual process goes on throughout an entire city, affecting its people as well as its lands and buildings.

That's why a town that appears unaltered on the surface may have changed drastically in some fairly vital respects. Say, for instance, that an industry moves out of town, and another comes in and replaces it, perhaps using the same plant facilities. To all appearances the city hasn't changed; one company has left town and a new one has replaced it. But where the old business may have employed only unskilled, older people, the new might call for young, college-trained technical personnel. Obviously, the influence of the latter group in terms of politics, educational and other family needs, and general community activities will differ widely from what the older people were doing.

Usually the changes that alter a city are greater than one industry replacing another. They may require quick, drastic action to remedy problems that are too aggravating to be solved by long-range city planning, such as rapidly faltering central business districts, cancerous slums, or inadequate traffic areas. To date, taking such action has been called urban renewal, the act of decisively cutting away urban decay to prevent it from spreading.

But urban renewal should be more than knocking down an old structure and replacing its inhabitants in a new but similar development. Too often such surgery maims rather than cures and frequently kills what it attempts to save.

*Should cities be eliminated?* Certainly not. There is a definite place in the world for cities. Too often planners hate the city and wish to destroy it or alter it so radically that it no longer contains any unique urban features and becomes only an enlarged vitiated rural town.

Rather than attempt to solve all urban planning problems within the governmental area which we call the city, we should use a much larger area, the metropolitan district. Within this would be a number of cities, each individual in character, purpose and design. They would not flow into one another but would be separated by green-belts and restricted in size. In this way, planning can preserve the best features of both city and rural living.

*How do you know when planning is needed for a given area?* A community needs planning when the following conditions exist:

1) If no regulations control the community's orderly development. Zoning laws are the legal means for managing the wise use of land and structures. But zoning isn't planning. Calling a tract of undeveloped land a residential area doesn't meet the problems of sewage disposal, roads, schools and commercial centers.

2) If tax rate returns are undependable. Stable or planned expanding communities produce dependable tax returns. A locality that isn't doing so, may be held down by the adverse effects of poor planning, such as a high rate of business failures and a high turnover in the ownership of homes, or the spotty growth of commercial services.

3) If the area or community is unattractive in appearance or inefficient in its functions. If this impression is poor, the town needs planning. Remember too, that expansion is not necessarily the goal of planning; refinement of the basic urban character of a city is equally important.

# WATER EVAPORATION

**UEL STEPHENS,**
**Director, Water Department,**
**Fort Worth, Texas,**
**and**
**Sec.-Treas., Southwest Water**
**Evaporation Research Council, Inc.**

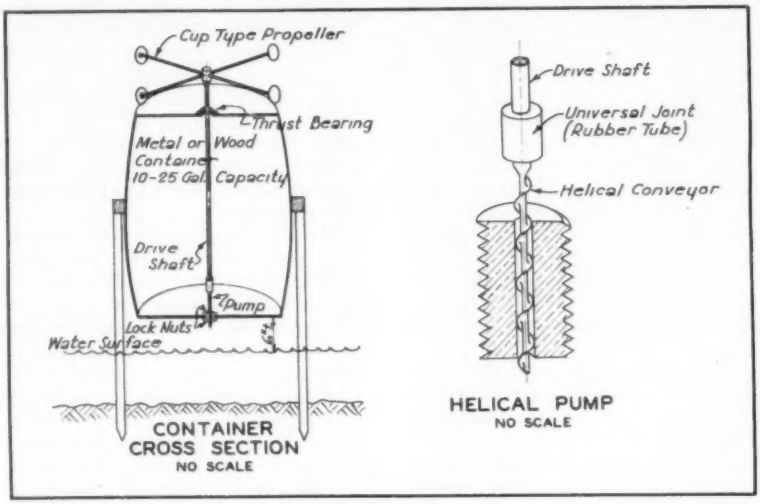
WATER conservation through reduction in evaporation may include such methods as: 1) Construction of storage reservoirs with maximum average depth and minimum exposed surface area; 2) concentration of water into single storage reservoirs; 3) elimination of marine growth; 4) elimination of shallow areas; 5) increasing storage of water in underground reservoirs by recharge of underground aquifers; 6) use of reservoir roofs, floating covers, sealments; 7) windbreak construction; and 8) application of monomolecular films to water surface. This discussion will be confined to the application of films though it is realized that each of the other methods has merit.

Realizing that retarding evaporation by a chemical film-forming agent would involve public water supplies, it is evident that every precaution should be taken to safeguard public health. Therefore, the material must not only reduce the rate of evaporation effectively, but it must be non-toxic to beneficial animal or plant life using the water as an environment or for consumption. The chemical agent should be resistant to oxidation or degradation by micro-organisms and should not detrimentally affect the biological balance of the reservoir, including oxygen and carbon dioxide transfer. The material should be effective in both hot and cold weather; and, probably most important, should be readily obtainable from commercial sources at prices which, with the application cost, would be practicable; and the application process must be simple and practical.

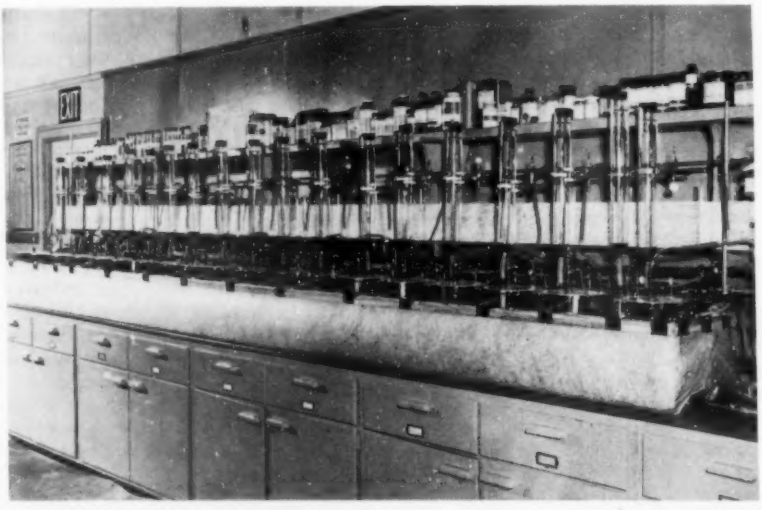
In December, 1955, the drought in the Southwest was fast becoming the most severe on record and water supplies of many communities were becoming depleted to a dangerous point. In some areas where rainfall averages only 8 to 10 inches the evaporation amounts to as much as 10 vertical feet. In 1955, a conference was held to determine whether it would be feasible to undertake a research program to investigate the possibilities of conserving water by reducing evaporation from surface reservoirs and lakes. With cash contributions assured, a project was commenced and before the work was completed early in 1958, the total funds raised amounted to $44,110.

As the research began in January, 1956 a Steering Committee, which was made up of the Finance Committee personnel, was formed. Later these two committees were dissolved, and the presently functioning Southwest Water Evaporation Research Council was incorporated as a non-profit research organization, assuming all of the responsibilities, liabilities, assets and functions of the Finance and Steering Committees.

In January, 1956, the Southwest Research Institute of San Antonio, which had already commenced preliminary work on the project, sub-




● **DESIGN by Howard Drew for applying a film-forming agent. Powered equipment has proved to be more satisfactory than floats, rafts or similar types of devices.**




● **SCREENING apparatus consisting of battery of 14 jars with specially designed covers and automatic water level controls was used by SRI in testing compounds.**

mitted a step-by-step outline of a program. Summarized briefly, this was planned to furnish information on the present status of investigations and developments; the best compounds to be used and the best methods of applying film forming agents; the coverage and life of surface films; the effects of the film on physical objects in the water (bathers especially), on temperature at the surface and underwater, on wave action and on marine life; the effects of rain and dust; the general effectiveness of film treatment, cost of application and estimated quantity of water conserved; and suggested methods of application to large reservoirs (over 100 surface acres.)

To avoid any question of the acceptability of the results, it was decided to divide the work between the Southwest Research Institute, the Geological Survey, and the Public Health Service about as follows:

1.) The guidance of the program, laboratory screening of compounds, field work, and preparation and publication of results, including a comprehensive final report, would be done by the Institute.

2) The Public Health Service through the Robert A. Taft Sanitary Engineering Center would cover: a) Human toxicity potential; b) effects on fish and marine life; c) effects on water treatment processes; d) effects on recreational use of water; e) resistance to bacterial attack; and f) final clearance of any compounds recommended.

3) The Geological Survey through its Denver office would measure water level changes, by developing a proper pan coefficient or by the use of mass-transfer and energy-budget approach, to determine the actual amount of evaporation reduction.

4) The Texas State Board of Water Engineers would act as the contracting agency and custodian of funds.

5) The Finance Committee of the Institute would produce the necessary funds up to the amount provided in the contract between the Institute and the State Board of Water Engineers ($25,000).

6) The Steering Committee of the Institute, acting only in an advisory capacity, would aid and assist the Institute and others in planning and carrying on the work.

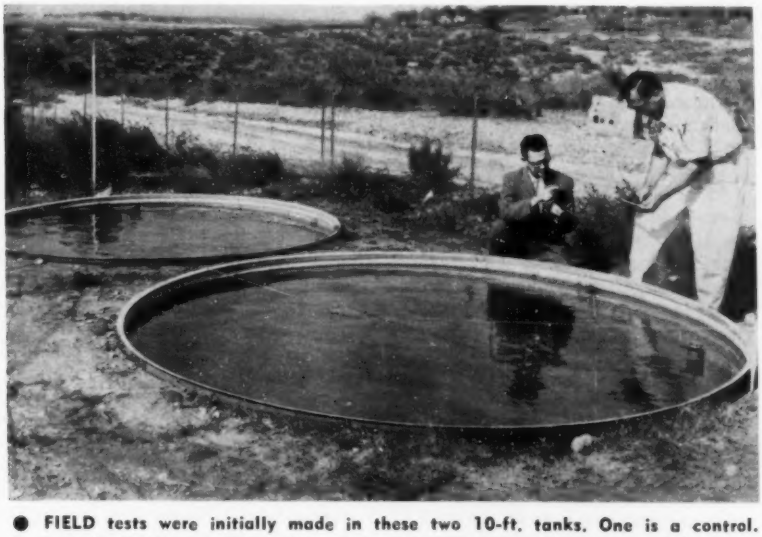
Through the two years plus of active research work, the assistance rendered by the cooperating agencies was invaluable. Without it the cost of completing the program would have been increased materially, and the results finally accomplished would not have borne the authentic approval of important Federal departments.

During the course of the laboratory phase of the program some 160 samples of compounds were tested, with the results for 149 samples being recorded in tabular form showing the sample number, test number, composition, trade name, supplier or manufacturer, percent of evaporation saving, and code number of test.

Each test unit of the laboratory equipment consisted of a battery jar 9 inches in diameter by 12 inches deep, fitted with a specially designed lid, an inlet for dry air and an automatic feed reservoir containing distilled water to replace that evaporated by the air stream. Air, dried by contact with silica gel, was passed over the water surface at the rate of 12.5 liters of free air per minute. In the test units, the compounds were applied in solid or liquid form at the equivalent rate of 1 pound per acre of the water surface. Two control units were run with each bank test. As the water in the jar was evaporated, the water level was maintained by automatic replacement from the reservoir. Thus by starting at a predetermined level, and refilling the reservoir to this level at the end of the test run, the amount of water evaporated could be determined. At a controlled temperature of 30°C (86°F) the control units generally lost about 2.5 liters of water during a test period of approximately 110 hours of continuous operation.

A second phase of the laboratory operations consisted of compound testing in open metal stock tanks located on the grounds of the Institute but far enough away from buildings, etc., so that natural outdoor, exposed conditions would prevail.

Two corrugated metal stock watering tanks, 10 ft. in diameter by 2 ft. deep, were buried in the ground to within 2 to 3 inches of the top. Each tank was fitted with a brass still well set on a notched glass plate. The test area was fenced off. In operation the tanks were thoroughly cleaned, flushed and filled with clean tap water. The material to be tested was applied by one of several methods to the surface of one tank; the other tank being used as a control. Evaporation was allowed to proceed under natural outdoor conditions until the film-forming material gave no further positive evaporation reduction effect as de-



● **FIELD tests were initially made in these two 10-ft. tanks. One is a control. Compounds tested were those which gave most promises as retardants in laboratory.**

termined by inspection of the data collected daily.

Data taken included the level of the water as determined by an average of three readings of the hook gauge in the still well in each tank; the surface temperature of the water in each tank; the air temperature; the wind velocity and direction; and the wet and dry bulb temperatures. These data were obtained mornings and evenings during the week and once on Saturday and Sunday. Fourteen separate tests were run varying in length from 72 hours to 64 days and the data for each test recorded in tabular form showing the following information: Test number, evaporation retardant, amount used (grams), length of test, type of application, and percent reduction in evaporation.

Test No. 8 report was as follows: Hexadecanol (mixed brands), 50.0 g., 64 days, Raft—copper bronze screen, and 16.7. Hexadecanol was compounded with 1 percent cupric stearate.

A study of the data collected during these experiments indicates that without a bacteriostatic agent, the film life was very short. Other conclusions drawn from this phase of the work were:

1) Even in cool weather, a dry "norther" will cause considerable evaporation. This indicates that the use of the monofilm technique is, under certain circumstances, advisable the year around.

2) A film in operating condition will assist in keeping a reservoir from freezing over. Examination of the energy budget theory confirms this experimentally determined phenomenon; the extra energy not consumed in evaporation must be withdrawn from the reservoir before freezing can occur.

3) Rain will break up the film; it will reform promptly, however, if adequate material reserves are present.

4) Periods of 100 percent relative humidity nullify the evaporation reduction effects of the film. This would indicate that the use of the monofilm technique is not economical in areas of continuously high relative humidity.

5) Any compound not giving excellent results in the laboratory screening phase was of little value in this phase of the program.

The results on the first few tests in the 10-ft. tanks indicated that some destruction of the film was taking place, or some other phenomenon was occurring which caused the effective life of the film to be short. When 0.6 mg/L copper sulfate was added to the water in the tank, the effective life of the film was increased materially. This emphasized the necessity for inclusion of some bacteriostatic or bactericidal agent either in the water or in the film-forming agent. Many experiments were made using various copper salts and other materials as bactericidal admixtures with film forming agents, but none of these admixtures received clearance of the U. S. Public Health Service and consequently their use on public water supply is not advocated.

### Ranch Ponds

This phase of the program was initiated by the Institute in its Essar Ranch Lake experiments and later extended to Moss Bluff Lake near Liberty, Texas (Gulf Coast Area); Cement Creek Lake near Fort Worth; Rio Farms reservoirs in the Lower Rio Grande Valley and a number of ranch ponds southwest of San Antonio. For these field experiments effort was directed mainly towards developing a satisfactory applicator; determining the effects of wind and wave action and bacterial action; and developing a simple inexpensive process which could be used by ranch hands and nontechnically trained personnel. Of these experiments only the one conducted on Essar Ranch Lake will be discussed in detail.

Essar Ranch Lake, 10 miles west of San Antonio has a water surface area of 28 acres when full, but during the experiment the water area was 4 acres and less. The water loss was evaluated by the Geological Survey using the energy budget method which requires extensive instrumentation and numerous calculations but results in much more accurate evaporation measurements than does the standard pan method.

The evaporation reduction results from the 1956 Essar Ranch Lake experiments are as follows: From 8/1 to 8/10, treatment with 2.2 pounds per surface acre with Octadecanol (Adol 62) resulted in an evaporation reduction of 4.0 percent; 9/10 to 9/20, treatment with 20.0 pounds per surface acre with Octadecanol (Adol 62), with evaporation reduction of 9.0 percent; 10/10 to 10/31 treatment with 20.0 pounds per surface acre with Hexadecanol (Adol 54) and 1 percent cupric stearate with evaporation reduction of 18.0 percent.

Floats or rafts of many different designs and materials were used but none proved to be satisfactory. Rafts of aluminum wire mesh seemed to attract bacteria and algae growths which clogged the mesh openings immediately and prevented dispersal of the film forming agent. Copper wire mesh was better but the conclusion was reached that raft dispersions are not satisfactory.

Field investigation by the SRI indicated that the wind effect on surface film is a major problem especially on large reservoirs, and solution of this problem should be the subject of further research. Suggested aids are windbreaks, both natural and artificial; a network of ropes, optionally saturated with a film-forming agent; and the application of the film forming agent at frequent points along the up-wind shore.

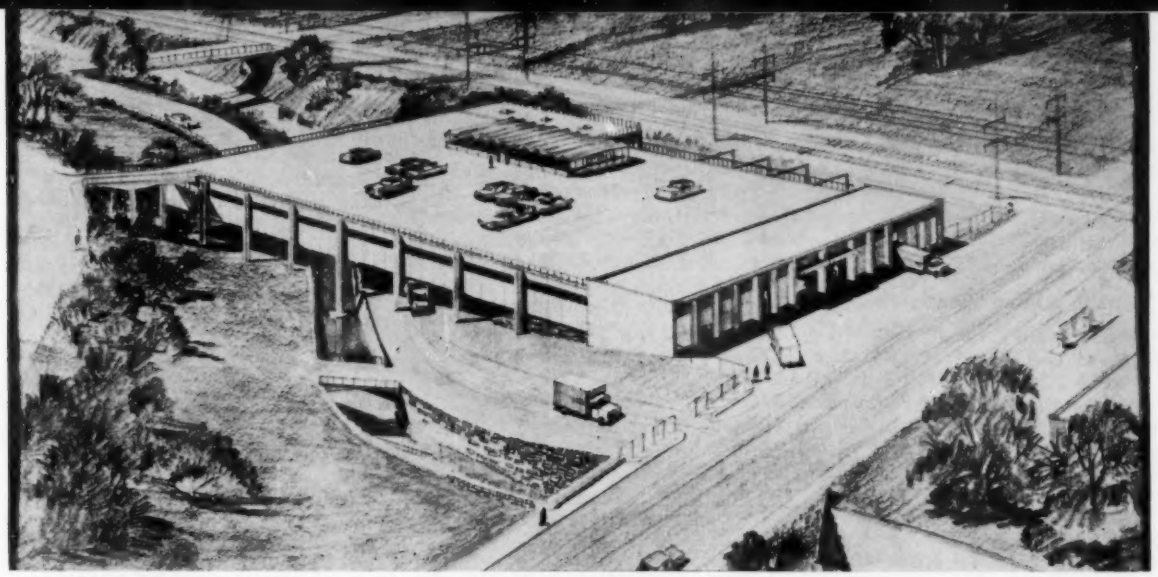
### Cement Creek Lake

Because of difficulties at Moss Bluff Lake and at San Antonio, where low evaporation rates and high rainfall made it difficult to measure evaporation and evaporation reduction, it was decided to use a flood control reservoir on Cement Creek above Fort Worth in which a small pond is maintained. This reservoir is convenient to nearby Meacham Field where the meteorological instrumentation necessary for accurately measuring evaporation could be located. Through the cooperation of the USGS, the Water District and Texas Electric Service Company, a small research program was begun at Cement Creek Lake in the fall of 1957. By the summer of 1958, a wind powered dripper, designed to introduce continuously very small quantities of a slurry or emulsion, was placed in operation on the lake.

Howard Drew of the Southwest Water Evaporation Research Council experimented on Cement Creek Lake, finding that the monomolecular film did not spread uniformly over the surface of an open pond or reservoir. The spreading was confined to a rather narrow V or U-shaped area. Higher wind speeds resulted in less spreading by reducing the angle of surface coverage. He devised a power driven dispenser using a solution or an emulsion form of the compound. Realizing that ranch stock ponds are usually far removed from sources of electric power and that gas driven equipment would not be practical, he investigated wind powered apparatus using a cup type of wind motor and a vertical helical conveyor acting as a pump on the lower end of the drive shaft.

These observations led Drew to two conclusions concurred in by Dr.

(*Continued on page* 158)



● PROPOSED garage will have main level for storage and maintenance, sheltered lower level and parking on the roof.

# CENTRALIZED GARAGE FACILITIES *Will Improve Vehicle Maintenance*

**JOSEPH A. ROSENTHAL**
**President, Engineers Incorporated, Newark, New Jersey**

FOR MANY YEARS, the garage facilities for municipal equipment in the City of East Orange, N. J., have been located at McKinley Avenue, at Midland Avenue, which is some miles distant, and at the Board of Education garage, with parking facilities at City Hall. During the spring of 1958 it appeared probable that the land area containing the gargae building and shop facilities at McKinley Avenue would be required for the extension of the proposed State East-West Freeway. This indicated that prompt action was imperative and the East Orange City Council, with the approval of Mayor William M. McConnell, retained Engineers Incorporated, consulting engineers, of Newark, N. J., to investigate, study and prepare a report with recommendations, concerning the use, garaging and maintenance of municipal vehicles and the associated problems of shop, tooling and storage space for the various City departments. This article is based on the final report of the consulting engineers.

### *Survey Procedure*

Following preliminary discussions with Arthur T. Brokaw, the City Engineer, a comprehensive survey and study was made of each interested municipal department to obtain the following information:

1) Number and kind of municipal vehicles in use at present and required in the foreseeable future; 2) frequency of operation of these vehicles; 3) parking requirements for municipal employees' cars in the vicinity of the centralized garage facilities; 4) shop space and other work space required for each department at present and the future; 5) storage space required for other equipment and material, both inside and outside; 6) procedure for maintaining vehicles and cost of vehicle maintenance by outside vendors and by municipal employees; and 7) extent of maintenance records and nature of policies established for vehicle purchases.

In addition to this study, further data on garage and vehicle maintenance practices was obtained from Newark, Trenton, Passaic, Hoboken, Clifton, Irvington and Essex County Highway Department in New Jersey; New York and Yonkers in New York State; Waterbury, Conn.; Quincy, Mass.; and Alexandria and Norfolk, Virginia.

Studies were also made on the advantages of centralized garage, storage and shop facilities; the required size of the facilities; space allocation for each department; alternate sites; advantages and disadvantages of centralized vehicle maintenance; a centrally located and uniform system for keeping records of vehicle and automotive parts; the operation of a centralized vehicle maintenance program; and an estimate of the operation costs.

East Orange, a community of 3.9 square miles, had a population increase from 68,900 in 1940 with taxable property assessed at $113,400,000; to 80,000 in 1950; and to 85,000 with an assessed valuation of $129,000,000 in 1957. As a corollary of this growth, the City has furnished additional services which in turn hav resulted in the need for additional vehicles and equipment; and it is estimated that this trend should continue during the next decade or two.

An inventory of municipal vehicles showed that at present there are 60 automobiles and station wagons, with 4 to be added in the future; 93 trucks and tractors, with 22 more to be added; and 57 pieces of miscellaneous rolling equipment.

The present contract for collection of refuse by outside vendors expires in 1960, so a centralized garage should provide space for future refuse vehicles.

### *Centralized Facilities*

There are a number of advantages of centralized facilities as compared with decentralized operations. For example, when vehicles are stored in a centralized location, mobilization of all municipal services can be more conveniently arranged in

**Table I—Needed Garage, Work and Storage Areas**

| Department | Garage Area | Work and Storage Area |
|---|---|---|
| | sq. ft. | sq. ft. |
| Engineering: | | |
| Refuse | 4,000 | 800 |
| Sewer | 3,870 | 2,900 |
| Street | 7,750 | 6,200 |
| Traffic | 2,200 | 5,050 |
| Recreation | 1,070 | 2,500 |
| Shade Tree | 3,870 | 2,950 |
| Water | 3,870 | 9,500 |
| Bd. of Education | 3,770 | 600 |
| Civil Defense | 600 | 500 |
| | 31,000 | 31,000 |

the event of an emergency. Centralized shops also permit joint employment of equipment useful to more than one department, as pumps, compressors, mixers, barricades, etc., thus eliminating duplicate inventories.

Many city departments utilize personnel whose normal duties require that they be employed outside. In heavy rains or in bad weather it becomes difficult to find productive work for this type of personnel. Each department head who has this problem recognizes it and, to the best of his ability, arranges for work in the shop during such times. Centralized shop facilities encourage more of such planning and also encourage department heads to assist one another in more complete utilization of personnel. There will be many problems in working out these joint ventures, but it will be easier to attain cooperation and efficiency in personnel use if the shop, garages and storage areas are grouped at a centralized location.

With all vehicles stored in a centralized area, a uniform system of record keeping on usage and maintenance costs becomes practical.

### Required Floor Area

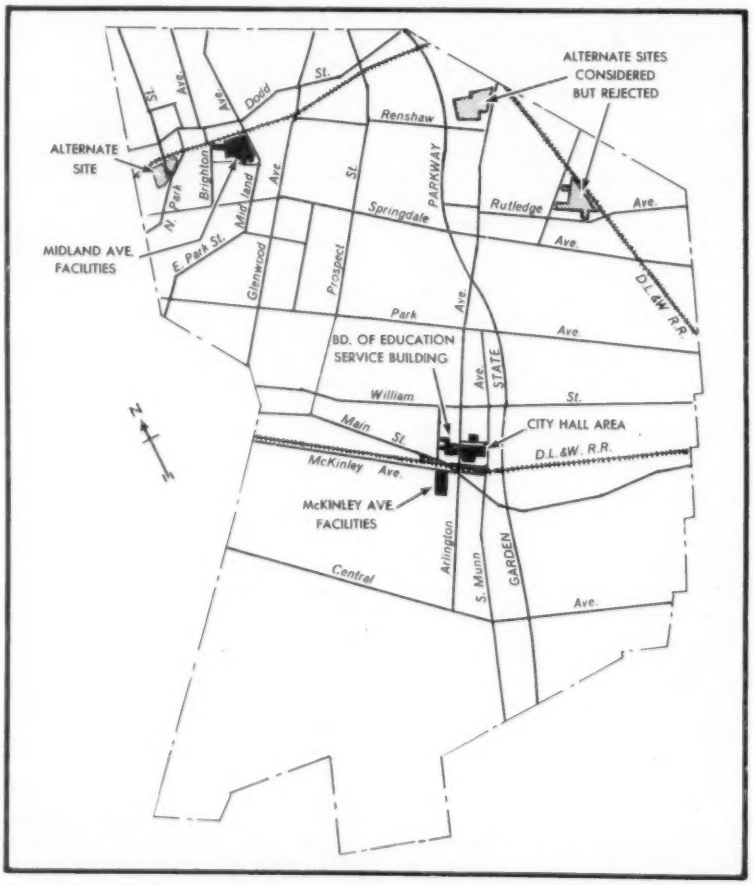
Studies were made of the operations and the space requirements of each of the departments. Needs aggregated 95,500 sq. ft., as indicated in part in Table I, compared to 55,400 sq. ft. in existing facilities. The 95,500 sq. ft. includes 31,000 sq. ft. garage areas; 31,000 sq. ft. work and storage area; 11,000 sq. ft. vehicle maintenance; 10,000 sq. ft. main aisle space; 2,600 sq. ft. for the office; and 4,900 sq. ft. for personnel facilities.

The proposed building will have an overall floor area of 199,000 sq. ft., divided as follows:

*Lower Level.* The lower level areas will provide 39,000 sq. ft. for the protected storage of materials normally kept outside, including man-hole covers, curbs, catch-basins, tree stakes, pipe sections, traffic poles and sign posts, as well as seasonal equipment such as snow and leaf removal equipment. In addition, this area will accommodate the movement of salt trucks to and from the discharge hoppers of the salt storage building.

*Main Level.* This level, which will be at approximately the same elevation as Midland Avenue, will provide 83,000 sq. ft. for shops, garage, maintenance and inside storage requirements for each department. A 30-foot-wide main aisle will extend the entire length of the building, separating the garage area from the shops and storage areas. The aisle will contain floor drains so that vehicles may be washed. It will also provide direct access to both Midland Avenue and to Brighton Avenue, as well as access to the garage area and to work and storage areas. In order to obtain access to Brighton Avenue it will be necessary to acquire a lot on this street, which, however, will provide additional outside storage space and snow dump.

The vehicle maintenance area will be arranged so that the stockroom, grease racks and washstand are on one side of the aisle. A clear ceiling height of 20 feet will allow maintenance of dump and future refuse trucks when the truck bodies are in a raised position. Gasoline pumps will be located at the main aisle in the maintenance area so that vehicles entering or leaving the building may be serviced at this point.




● MAP of East Orange shows location of existing and proposed garage facilities.

The Superintendent's office will be situated to permit a clear and unobstructed view of the entire main aisle of the garage.

*Upper Level.* Access to the roof parking area for private vehicles will be from Everett Street; this level will provide for the parking of approximately 260 vehicles and 7,500 sq. ft. for offices, locker rooms, toilets and personnel areas. Stairs from this area will allow direct access to the main aisle on the Main Level.

*Side Addition.* Salt will be unloaded directly from railroad hopper cars into a 5,000 sq. ft. side addition which will provide space for salt storage; or if the salt is delivered by truck, the trucks will drive over the roof and dump directly into the storage hopper.

In addition, 7,200 sq. ft. of outside pipe storage area is to be provided for the water department and 40,000 sq. ft. for other storage purposes, including leaf mold, tree stumps, sand, gravel, stone, patch material and such materials as broken paving and curbing prior to disposal.

Foundations, columns and upper level framing will be designed to permit the addition of a second story to the proposed facilities for future expansion. The new roof would then become the parking area.

### Alternate Sites

Having determined the various floor areas required for efficient operation by the various municipal departments and functions and thus arriving at total area requirements, the centralized garage building could be planned and a site selected to accommodate the building.

Several alternate sites which would require condemnation, were examined but were found to be unsatisfactory. The consulting engineers, therefore, recommended that the Midland Avenue property be used for the new facilities unless it is definitely established that additional sites might become available as a result of the construction of the State East-West Freeway project.

### Estimated Cost

Complete construction cost is estimated by Engineers Incorporated to be $1,043,200 including $19,200 to cover the purchase price of a lot to supplement the site area. There will probably be an offsetting credit against the overall construction cost because of abandonment of the McKinley Avenue site. The real value of the land and buildings as furnished by the City Board of Assessors is $136,000.

If a site of ten or twelve acres having reasonable expansion area were available, a one-story building with a ground level parking lot could be constructed for $240,000 less than the proposed Midland Avenue construction. Site conditions at Midland Avenue create construction difficulties such as: Retaining walls to confine the Second River so that the lower level will not be flooded during a heavy rain; heavy framed floor construction over the lower level due to topography of the site; roof parking requirements due to limited areas; and increased size of columns and footing to allow for future expansion of the building upward an additional story.

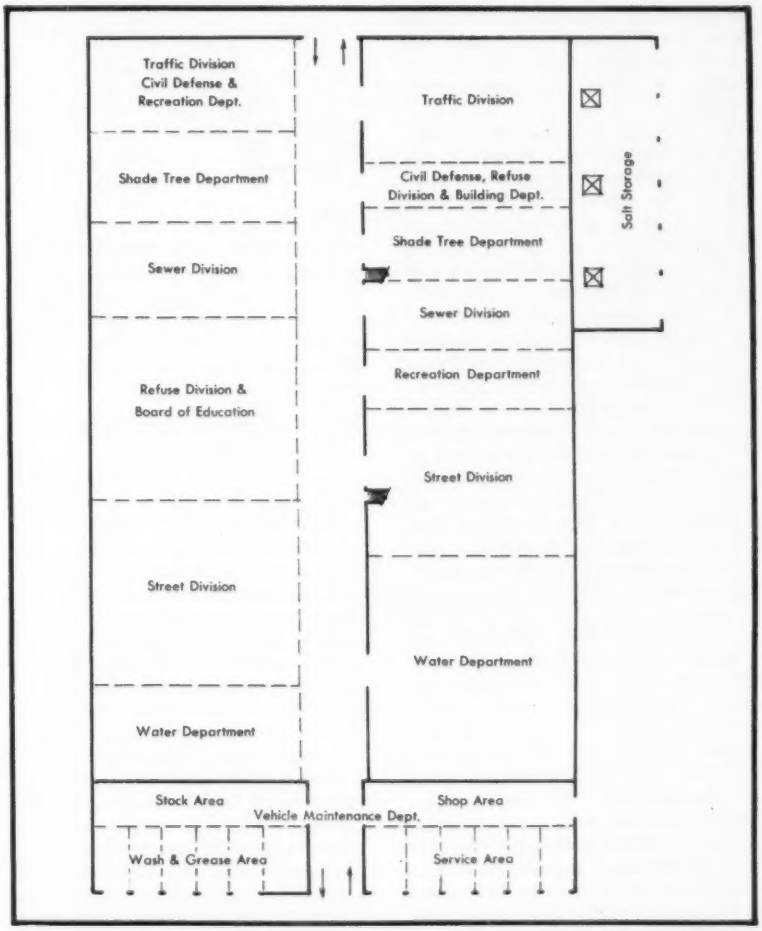
However, what appears to be a penalty of $240,000 for the use of the Midland Avenue site really provides additional useful area totalling 111,000 square feet in the roof parking, in the upper level building areas and the protection of the lower level from inundation.

The overall construction estimate includes $30,000 for specialized equipment to enable mechanics to do all of the necessary maintenance work, except body work. The engineering survey revealed there is little collision damage to City vehicles, but when these occur, required repairs can be more effectively performed by an outside shop.

### Centralized Maintenance

Included in the report of Engineers Incorporated are recommendations for the establishment of centralized maintenance facilities to serve municipal vehicles. A uniform preventive maintenance program should be organized, planned and controlled by a Superintendent of Automotive Maintenance, who would have at his disposal proper space, a staff of seven trained mechanics, one clerk- typist, a stockroom attendant and four garage attendants. A centralized stockroom will eliminate duplicate inventories of standard repair and replacement parts. Cost records will be uniform.

The advantages of such a program are numerous. It will provide de-




● **MAIN LEVEL of the new garage will be assigned to departments as shown above.**

partment heads with more time for their operating duties. It should reduce equipment breakdown by establishing better preventive maintenance. It will permit a uniform system of keeping use and maintenance cost records and comparisons that will permit wiser overall decisions in procuring new equipment. It will permit the Superintendent to assist each department in preparing specifications for needed equipment and in recommending standardization of vehicles where desirable. It will provide a greater opportunity to repair worn parts and assemblies removed from vehicles and to use them for replacements on other vehicles. And it should be possible to provide faster service than is available from privately owned shops.

From numerous interviews and from observations of other municipalities, there appear to be only two potential disadvantages in establishing centralized maintenance: (1) Capital is required for the additional building area and the maintenance equipment; and (2) in establishing such a department with rigid requirements for qualified trained personnel there will be difficulty in hiring competent mechanics.

The key to an efficient centralized maintenance program is the Superintendent. He will be responsible for the planning and administering of the maintenance program for each vehicle and for scheduling its repair. He must be cognizant of the particular operating problems in the various departments and recognize the importance of those departments having emergency maintenance situations so that proper priority may be given.

Since the City Engineer administers the affairs of the public works program, and his department contains a substantial percentage of all city vehicles, it is recommended by the consulting engineers that the Superintendent of Maintenance report to the City Engineer.

### *Vehicle Maintenance Costs*

In 1957, East Orange spent $75,000 for maintaining all municipal vehicles. No positive information is available as to the exact ratio between expenditures for labor and material, since records are kept merely by vendors' invoices; however, from qualified sources it is determined that approximately 60 percent of the total payments to vendors is for labor and the remainder for material. The total labor cost then for vehicle maintenance for 1957 can be calculated to be $33,000 for East Orange labor plus 60 percent of $42,000 for vendors' total charges, or a total of about $58,200 for all labor.

From the detailed salary schedule of personnel it is indicated that the estimated cost to the City for their maintenance schedule was $58,500. The cost for the labor force recommended for the centralized maintenance facilities is approximately the same as the present expenditure for vehicle maintenance work. It should be emphasized, however, that the vehicles under the proposed centralized maintenance program will individually receive more attention and care by installing the preventive maintenance system and by so doing the useful life of municipal vehicles should be extended and total equipment expense reduced.

A further investigation was made of other municipalities and agencies in the vicinity of East Orange which perform some of their vehicle maintenance at centralized maintenance centers. The number of vehicles serviced per mechanic for each of the selected agencies is presented in Table II.

**Table II—Survey of Automotive Maintenance Personnel**

| City | *Vehicles Serviced per Mechanic* |
|---|---|
| Newark, N. J. | 22 |
| Clifton, N. J. | 36 |
| Essex County, N. J. | 23 |
| Norfolk, Va. | 17 |
| New York City Boro Works | 17 |
| Average | 23 |

### *Private Vehicles and Equipment Rentals*

Since the Health, Library and Recreation Departments of the City of East Orange have arrangements whereby municipal employees use their private vehicles for municipal work, a comparison was made between current costs and the estimated cost of operating municipally owned vehicles for the same service. The study indicates that the present rates are advantageous to the city. The Health Department pays 7 cents per mile; the Library Service 25 cents per trip and the Recreation Department $37 per month. For the three groups, 17 cars are involved.

Basically, there are only two considerations affecting the leasing of automotive equipment: Emergency requirements and cost. In the case of emergencies such as snowstorms, it has proved more economical for the City to rent the added required equipment.

To determine the true difference in cost between leasing and owning vehicles, it is necessary to have accurate cost records which are not available under the present operating procedures; however, with the recommended initiation of a central maintenance shop, essential records will be accumulated and can be used to advantage. The Engineers' report, therefore, recommends that no changes be made in the present leasing program or use of private vehicles pending further information when available.

Pooling of City vehicles—passenger cars, station wagons, trucks and specialized vehicles — was given careful consideration but since very few municipally owned vehicles are not in daily use, it was concluded that the present system of vehicle assignments to departments should be continued.

### *The Fire Department*

During the consulting engineers' investigation, the City Fire Chief and the Board of Fire Commissioners in particular, as well as other departments, expressed concern regarding priority for maintenance of their vehicles. In addition, the specialized nature of fire apparatus requires the services of specially trained mechanics. It was thought desirable by Engineers Incorporated to check the practices of other cities in this respect and it was found that out of the ten cities responding, only two used centralized facilities. Therefore, the engineering report recommended that the centralized maintenance facilities be established for all departments except the Fire Department, pending the accumulation of experience and data in the operation of centralized facilities.

### *Conclusions*

Due to space limitations, complete details on a project of this nature cannot be presented, but in formulating their recommendations Engineers Incorporated has been mindful that engineering is a live and growing thing and its fluid development should be in the direction of its functional purpose.

The engineering studies include the calculation of reasonable future probabilities, subject to continuing check, on the basis of all the factual information that could be assembled, and the employment of the methods which careful workers in business, economics and engineering have been developing over a period of years.

# THE FINANCIAL PLAN
## *and Community Development*

**HARRY L. SEVERSON,**
**Financial Analyst**

AS THE modern way of life makes greater demands upon local governments their financial problems become more complex. This means that budgeting becomes more important and the process more complicated. The great increase in the demand for capital improvements which are typically financed by borrowing makes the preparation of a long term financial plan essential. Furthermore as the supply of outstanding tax exempt bonds increases relative to the demand, poorly prepared offerings will suffer pricewise in contrast with carefully tailored offerings issued under a sound debt plan.

The rapid growth of the population around the older cities has brought new and heavier responsibilities to many jurisdictions in advance of a corresponding increase in their sources of revenue, while the illogical structure of local governments in most metropolitan areas adds to the complications involved in raising the additional revenues required to finance these services. The basic forms of our political institutions were developed in an agrarian economy, and only piecemeal changes (usually additions tacked on) have been made as villages grew into cities and then into metropolitan areas. This rural orientation of so much of the governmental structure in the midst of predominantly urban economy tends to obscure the full implications of the fact that the vigor of the great metropolitan areas largely determines the strength of the Nation.

The desirability of a carefully prepared financial plan in which the volume and maturity distribution of future bond offerings are carefully scheduled are well-known to students in this field. Unfortunately, however, the costs and wastes of inadequate financial planning do not ordinarily begin to pinch for some time after the bonds are issued with the result that the voters are often oblivious to them until a serious situation has developed. Once the public does become suspicious that all is not well, a sharp reaction is likely to develop. New investments in factories, office buildings and housing are avoided. Stated otherwise, progress passes this section by, and a new pocket of economic and social retrogression has started in the metropolitan area. At this point, heroic measures are required to reverse the downward spiral.

### *Start the Plan Early*

The earlier a political jurisdiction starts on a financial plan, the better. Although the finishing touches cannot be placed on such a plan until the physical plan has been completed and other parts of the capital budget have been carried to a point where the total volume of needed funds and the timetable are known, it is constructive to regard the engineering and financial plans as different facets of the same basic problem. The realization some years ago of the great contribution which physical planning could make to more efficient local government resulted at times in over-enthusiasm. In a few instances plans for large public improvements were developed without regard to cost or methods of financing. The limitations of such an approach are so obvious, once they are pointed out, that some political leaders now refuse to consider a plan for a major project unless there is a rather clear indication of how the money can be raised.

There is also an important negative reason for starting a financial plan as early as possible, namely the avoidance of a type of bond issue or indenture provisions which will later prove to be embarrassing. When expediency is the main consideration in the planning of each new bond offering, provisions are likely to slip into the indenture which appear to make the particular issue more attractive but which may become unduly restrictive on management at a later date. Once this gets started, the easiest solution each time a new offering comes up seems to be still more pledges, and so the rigidities multiply. The irony is that the bond holders, for whom these pledges are presumably made, are often not well protected by them. Basically an assurance of good management adds more to credit quality (and lower interest for the borrowers) than strict pledges. Inflexibility makes it difficult for competent management to do a good job, and only in a very limited way can these pledges protect investors from the folly of weak officials. The almost irrevocable character of most indenture provisions make the revamping of a haphazard debt structure a long and frustrating task. After a crisis has developed, the suggestions which a

(*Continued on page* 170)

# SERIAL DISTRIBUTION of SEPTIC TANK EFFLUENTS

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SOIL HAS BEEN used as a medium for subsurface disposal of effluent from individual household septic tank systems for over fifty years. However, it is only within recent years that soil conditions which provide successful disposal have been studied. Even now little is known concerning the proper type of pretreatment of sewage or method of application of effluent necessary to obtain maximum efficiency of the system. Furthermore, soil receiving treated sewage is subject to biological, physical, and chemical clogging. Little is known of the fundamentals involved, or of the features which should be designed into an absorption system to minimize clogging.

The *Manual of Septic Tank Practice*[1] is one of the most comprehensive sources of information available on this subject. However, the Manual was based on data available prior to 1954, and recent investigations have provided enough additional information to indicate that changes should be made in the designs recommended for disposal fields. The Manual states that:

> A distribution box is considered essential for every absorption field system. The purpose of the box is to insure equal distribution of effluent to the several lines.

A radically different design in which the distribution box is eliminated has now been proposed as a result of a series of studies financed by the Federal Housing Administration and conducted by the Robert A. Taft Sanitary Engineering Center of the Public Health Service, Department of Health, Education and Welfare.

Three independent, but mutually supporting investigations were commenced late in 1956: To develop practical design criteria for seepage pits; to develop practical design criteria for seepage beds; and to determine if distribution boxes can be eliminated without inducing increased failure of disposal fields.

The distribution box study has been completed, the seepage bed study will be completed this year, and the seepage pit study should be finished in 1959.

A group of consultants consisting of Professor P. H. McGauhey, University of California, C. S. Slater, Department of Agriculture, and Professor H. A. Thomas, Harvard University, assisted in planning the projects, and are still active in reviewing progress and in assisting in the analysis and interpretation of results. J. R. Simpson, Chief Sanitary Engineer, and Bernard T. Craun, Sanitary Engineer, both of the Federal Housing Administration, participate in the meetings with the consultants and provide liaison with that agency.

So far in these studies, over 3,000 individual septic tank systems have been examined. Field teams under the direction of a sanitary engineer or a soil scientist have worked for at least three months in each of 20 counties in Arizona, California, Kentucky, Louisiana, Michigan, Missouri, North Carolina, New Jersey, and Tennessee.

In the examination of each septic tank system, design detail and a history of loading and performance was obtained. Every soil absorption system and in some cases the septic tank itself was examined in a degree of detail that depended upon the particular study for which the examination was made.

### The Distribution Box

The provisions in the *Manual of Septic Tank Practice* are based on the assumption that uniform distribution of the septic tank effluent over the entire soil absorption area is desirable. It had been assumed that equal division of flow to the several absorption trenches would insure maximum use of the entire designed area. This was believed especially true on sloping ground where differences in elevation present a threat of overloading the lower trenches while the upper trenches receive little if any effluent. It also had been assumed that the potential maximum life of the system would be assured by spreading the flow uniformly over the entire area.

The study to determine the possible elimination of the distribution boxes without increasing failure of disposal fields was made by comparing the performance of septic tank systems having distribution boxes with that of systems using some other method of distribution. The study has been completed and a final report[3] is available. The investigations were made in St. Louis County, Missouri, and in Rapides (Alexandria) and Caddo-Shreveport Parishes, Louisiana. The cooperation of these health departments as well as of the Missouri and Louisiana State Health Departments was important to the success of the study.

After analyzing the performance data from over 1,600 systems, the following conclusions were made:

1) Distribution boxes can be eliminated from septic tank soil absorption systems in favor of some other method of distribution without increasing the failure rate of disposal fields. In fact, evidence indicates that distribution boxes as presently used may be harmful to the system.

2) Data indicate that on level ground, equal distribution is not necessary if the system is designed so that an overloaded trench can drain back to the other trenches before failure occurs.

3) On sloping ground the method of distribution must prevent excessive build-up of head and failure of any one trench before the capacity of the entire system is utilized. Distribution boxes as presently used probably act as diversion devices sending most of the liquid to only part of the system.

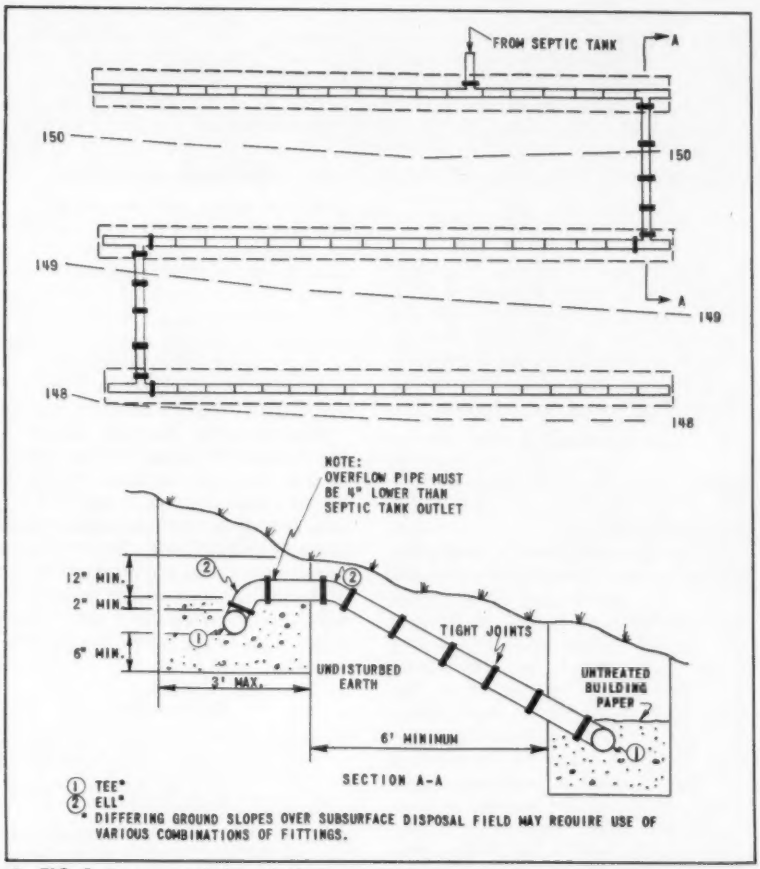
4) Before attempting to perfect a device necessary to accomplish equal distribution with its consequent increase of control and inspection, a comparison of equal distribution with serial distribution is desirable.

### Serial Distribution

Serial distribution in an absorption system is accomplished by the use of separate trenches connected in a series. All of the effluent is discharged to the first trench and an overflow line is arranged so that the trench is forced to pond to the full depth of the gravel before liquid flows into the second trench. The overflow line lies below the surface of the ground on undisturbed earth, and is arranged to give relief before liquid seeps to the surface. Succeeding trenches come into play in serial sequence so that the total absorption area of the entire system is utilized before final failure can occur.

Even though the record is meager, serial type systems have been more widely used than is generally recognized. In our investigations, serial types have been encountered or their use has been reported in Alabama, Mississippi, Missouri, New York, North Carolina, Oklahoma, and Tennessee.

Serial arrangements take different names in different localities. An early instance coming to the attention of Center personnel concerned the use of "step down" systems in Mississippi. As a result of correspondence with Dr. Felix J. Underwood of the Mississippi State Health Department, a series of "bench type" experiments were made on selected soil cores. The favorable results of these unreported experiments indicated the need for the distribution box study. The "land block" systems of St. Louis County, Missouri, were investigated and the results are presented in the following section.




● **FIG. 1. Recommended method of ground disposal for septic tank effluent on side-hill areas. This reduces overloading of lower level lines and results in a longer life.**

Kiker [4] shows an illustration of the use of "drop boxes" from the New York State recommendations. Other state bulletins illustrate drop box arrangements without commenting on the use of serial distribution. Quenelle [5] has developed, studied, and reported on the use of "S" type systems in Alabama. A number of states use long single trench systems which in effect work on the serial principle.

In line with the fourth conclusion of the distribution box study, the data were re-examined to compare the performance of serial and parallel distribution systems. In St. Louis County, Missouri, the land block method of serial distribution was used for a number of years during the early 1950's and in the course of the study, 70 installations were encountered.

Their performance was compared with 171 distribution box systems installed at the same time under similiar conditions. The percent failures of distribution box systems and land block systems were, respectively, 12 and 9 where there was no alteration of topography and in level ground (4 percent or less slope); 20 and 0 for cut and fill construction and level ground; 44 and 21 in sloping ground and with no topography alternation; and 100 and 40 where cut and fill was used in sloping ground.

An effort was made to select systems where conditions of use would allow a direct comparison of performance. In spite of this effort, the distribution box systems were on the average younger, contained slightly more absorption area, and were located in better soils. While data are insufficient to demonstrate a statistically significant difference in performance, a lower failure rate with serial distribution systems was observed, particularly on sloping ground. This trend exists despite the fact that parallel systems were clearly favored on area, age, and soils. Under these conditions performance of parallel systems should have been superior to serial systems.

### Theoretical Advantages

*Improved Hydraulic Control.* Many times during the current studies the need has been observed for positive hydraulic control necessary to bring liquid into contact with the soil absorption area, especially on sloping ground. It has also been observed that this control is not achieved with the distribution box.

With anything less than perfect division of flow in a system of parallel trenches installed at different elevations, one trench is almost certain to be overloaded and eventually becomes surcharged. If the differences in elevation between the surcharged trench and the distribution box or other flow splitting device are such that the trench cannot relieve itself to other parts of the system, surface seepage and local failure will occur before the full capacity of the system can be utilized.

If an approximately perfect division of flow is to be achieved, distribution boxes must be constructed and installed with far more pre-

cision and attention to detail than in present practice. Furthermore, to obtain an equal split of flow during the 10 to 20-year life of the system, the box must be maintained and adjusted frequently.

*Absorption Capacity of Trenches.* The variability of soils, even in the limited area of an individual disposal field, makes the desirability of uniform distribution doubtful. Many factors, alone or in combination, may lead to nonuniform absorption capacity of the several trenches. Varying chemical and physical characteristics of the soil, construction damage such as soil interface smearing or excessive compaction, poor surface drainage, influence of plant growth, and variation in depth of the trenches are some of the factors involved.

If the absorption capacities of the trenches are not equal, the principle of equal flow is immediately fallacious. Serial distribution minimizes the dependence on absorption rates because each trench absorbs effluent to its ultimate capacity. With equal distribution, success is limited to the capacity of the weakest trench; with serial distribution, full use is made of every trench.

*Treatment of Liquid in Ponded Trenches.* Sewage effluent continues to receive treatment as it progresses through the serial system. Each trench provides conditions similar to a contact bed, improving the quality of the liquid before passing it to the succeeding trench. Thus, even after a trench is ponded and technically has failed, it continues to provide biological treatment of the effluent passing through it.

The treatment received in any of the series of trenches will prolong the life of succeeding trenches. This assumption can be demonstrated by the mathematical formulation of soil absorption capacity being developed in the current studies. The absorptive capacity, L, of a soil is given by the following equation:

$$L = \frac{fPt}{A}$$

In this equation, L is the unit areal load capacity of the soil. Numerically, L represents the number of years that one square foot of soil-liquid interface can accept waste water of a single "equivalent" person before the interface becomes permanently clogged. In present investigations, L is measured directly from performance data by use of the equation. Soil tests, such as the percolation test, are made at the same time so that eventually L may be estimated by performing one simple test.

A is the effective area of the soil-liquid interface when the permissible ponded level is obtained; t is the useful life of the system, i.e., the number of years required to reach permissible ponded level; P is the number of persons in the household; and f is a factor by which P is multiplied to obtain an "equivalent person" load. Thus, f reflects the type and extent of sewage treatment prior to soil absorption and the presence or absence of appliances such as food waste grinders, automatic washing machines, or other factors affecting the total volumetric or organic sewage load. Since the bulk of data pertains to septic tank effluents, it is convenient for the time being to set $f = 1$ for households with septic tanks but without food waste grinders or automatic washing machines. The magnitude of f decreases with more complete treatment and increases with the addition of appliances.

When this equation is applied to a distribution system of three trenches with equal absorption area, and when the three trenches are connected in parallel, and flow is divided so that all of the absorption area is used, the useful life of the system is given by the equation:

$$t = \frac{AL}{fP}$$

where A is the combined area of all three trenches and $f = 1$ for septic tank effluent.

When the trenches are connected in series, the time required for the liquid to reach the permissible ponded depth and start to pass to the second trench will be t/3 because f, P, and L are unchanged and the area is one-third of the total area A. However, in recognition of the treatment received in the first trench, a value of f somewhat less than 1 must be assigned to the liquid reaching the second trench. Since all other factors are unchanged, the useful life of the second trench is greater than t/3, and the useful life of the third trench is greater than that of the first or second.

It is evident therefore, that the total useful life of the serial system is greater than that of the parallel system. Unfortunately the science has not progressed to the point where quantitative values can be assigned to f to demonstrate the degree of additional benefit obtained.

### Revision of Manual

A proposed addendum to the *Manual of Septic Tank Practice* including design criteria has been prepared by the General Engineering Program of the Public Health Service and is being circulated for comment to the members of the Joint Committee on Rural Sanitation. Its early adoption is expected. The proposed addendum permits the use of any method of distribution if the ground surface slope in the absorption field area does not exceed a maximum fall of 6 inches, provided overloaded trenches can drain back to other trenches before break through to the ground surface occurs. Serial distribution is to be required when the ground surface fall exceeds 6 inches, the system being designed as indicated in Fig. 1. This method is only one of a number of possible arrangements, but in all schemes the general principles listed above must be followed to avoid inferior results.

### Economic Advantage

Use of serial distribution systems will result in substantial reduction of installation costs. The size of saving can be estimated from a comparison of a standard distribution box with that shown on Fig. 1. Depending on terrain and the amount of tight-joint pipe eliminated, the reduction in first cost will be approximately $15 to $30 per system.

Commissioner Norman Mason of the Federal Housing Administration stated that the annual saving in construction costs as a result of the adoption of serial distribution would amount to $4,000,000. The saving to home owners as a result of better performance and fewer failures is difficult to estimate but could amount to many times the original saving.

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4) J. E. Kiker, Jr., *"Subsurface Sewage Disposal"*, University of Florida, Gainesville, Florida (1948).
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# 75,000 SIGNS GUIDE TRAFFIC IN SEATTLE

● AT MAJOR intersections, such as this, channelization and pavement markings are combined effectively with signing.

**E. E. LEWARCH,**
**Traffic Engineer,**
**and**
**EARL SUCCO,**
**Public Information Assistant,**
**Seattle, Washington**

SCENIC Seattle, with its rather unique location between two large bodies of water and its unusual topography, presents many traffic problems. Whatever the condition that may require traffic signing, we probably have it in Seattle.

We use 140 different types of regulatory signs, 45 types of warning signs, and many other special signs to fit particular situations. By way of inventory, there are nearly 75,000 traffic signs in place, plus 54,000 street name signs, 16,000 traffic buttons, 4,500 reflectors and 1,200 channelizing islands and safety fences. All of these non-electrical traffic control devices are installed and maintained by 28 men in the Traffic Sign Shop of the Traffic Engineering Division.

Nearly 6,000 traffic control signs are installed at new locations yearly, and approximately 10,000 traffic signs are installed to replace signs which had been damaged, removed, or in place more than five years. All of these signs are painted and processed by four men in the Traffic Sign Shop. In addition to the traffic signs, over 1,000 posters with traffic safety slogans are painted every year. These posters are replaced at approximately 100 locations throughout the city every month.

All the process screens and stencils used in painting traffic signs, and also those used for painting street marking legends, are designed and constructed in the Traffic Sign Shop. The construction of the silk screen stencils, designed so that several colors are used on the same sign (as on posters), is a complicated process and is accomplished only by first-rate sign painters.

A portion of the material from which traffic signs are made is salvaged from other signs that are obsolete but still in good condition. For example, some of the legend plates on parking meters were salvaged from old metal stop signs that are no longer standard size. These obsolete signs are first placed in a chemical tank to remove the old paint and reflectorized material, then are scraped and sanded if necessary, and cut to proper size. When the traffic signs are ready to be painted they are first given a primer coat, then a coat of enamel. A stencil is used to paint the lettering. A vacuum applicator is used to apply reflectorized material on stop signs, warning signs, one-way street signs and large directional signs.

Several thousand wood traffic sign posts are processed every year. These cedar posts vary in size from 4 ins. x 4 ins. to 10 ins. x 10 ins. and are painted white, with the exception of stop sign posts which are painted with alternate red and white stripes, and YIELD RIGHT OF WAY sign posts which are painted with alternate black and yellow stripes. Broken sign posts that are over four feet in length and still in good condition are salvaged, repainted and installed at locations such as truck loading zones, where shorter lengths are in standard use.

### *Cleaning of Signs*

Approximately 10,000 traffic signs are steam cleaned in place every year by using a "steam jenny". Steam cleaning traffic signs is a two-man operation. One man remains on the platform of the rig and the other drives. It takes an average of from 20 to 40 seconds to clean a sign, depending on size. All traffic signs in the Central Business District and on arterial streets are cleaned once a year; signs in residential areas are given a periodic cleaning as the need arises.

In 1955, one-way street operation was installed on 23 miles of streets in the Central Business District of Seattle. The new traffic pattern gave Seattle Traffic Engineers an opportunity to develop some new traffic signing techniques to meet traffic demands. The problem of drivers turning the wrong way into a one-way street was effectively reduced by supplementary signing. "One-Way" traffic signs 18 ins. x 24 ins. in size are mounted at a 45° angle on four-foot metal standards. These signs are installed in the street at intersections in such a manner as to be clearly visible to the driver and so as not to interfere with the pedestrian movement. After a trial period of a year at selected locations, vehicular damage to these signs was so slight that this type of signing was adopted for the entire one-way grid system.

Seattle's parking problems are accentuated by steep grades on several

streets in the Central Business District. Back-in Angle Parking was one innovation in traffic operation installed to provide additional parking spaces and also to eliminate the runaway type of accident prevalent on these streets with parallel parking. The parking stalls are designated at a 70° angle to facilitate the back-up movement. Each parking meter, moved back from the edge of the curb, has a sign with the legend Back-In Angle Parking Only and at least two larger overhead signs with this legend are installed on utility poles in each block. This style of parking is installed only on one-way streets of sufficient width where traffic volumes are moderate. The back-in method of parking has proven to be not only effective but also very popular with Seattle drivers.

### *Reversible Lane Operation*

Reversible lane operation is used to expedite the movement of large volumes of traffic on Aurora Avenue, a six-lane major arterial street. This reversible lane extends for a distance of three and one-half miles northerly from the north edge of the Central Business District. Four lanes are provided for inbound traffic during the morning peak traffic hours, and for outbound traffic during the evening peak traffic hours. The dashed lane lines next to the double center lines, or medial dividers, are supplemented with a dashed red lane line to denote the reversible lanes. Traffic cones are placed approximately 150 ft. apart on the lane line except at two major on-ramps and at both ends of the reversible lane. At these locations the cones are placed closer together to mark clearly the reversible lane for the major flow of traffic. These cones are set down and picked up twice daily by a two-man crew from the Traffic Sign Shop. Each operation takes approximately 20 minutes.

A large overhead sign with flashing beacons and the legend DO NOT USE THIS LANE WHEN FLASHING is installed at the north end of the reversible lane. An illuminated automatic traffic sign installed on a mast-arm-mounting over the reversible lane is located south of a major on-ramp. The legend on one side of this sign reads DO NOT USE THIS LANE. The other side of the sign has the legend USE THIS LANE. This sign automatically changes twice daily so that the legend USE THIS LANE faces the major flow of traffic. Other special signs with the legend NO LEFT TURN FOR NEXT .. (distance)

● **REVERSIBLE** lane operation is in effect during the evening peak load period, providing four lanes for outgoing traffic, with sign and flashing signal control.

● **STEAM JENNY** mounted in truck steam-cleans 10,000 signs in place annually. A two-man operation, it takes an average of 20 to 40 seconds to clean the usual sign.

● **ALL PROCESS** screens and stencils used in painting traffic signs, and those for street marking legends also, are designed and constructed in the Sign Shop.

MILES are installed at several locations along the reversible lane route to prevent drivers from making hazardous left-turn movements.

The reversible lane operation with its supplementary signing is very popular with the 70,000 drivers who travel on this portion of Aurora Avenue on an average weekday.

Seattle traffic engineers are firm believers in large overhead traffic signs to serve as route markers, directional signs and lane designators. Although there are a limited number of larger overhead signs installed at the present time, the Traffic Engineering Division is gradually working into a comprehensive overhead signing program using both plywood and metal destination signs with white lettering on a green background. This is the color combination used extensively for destination signs installed in rural areas by the Washington State Department of Highways.

Most of the overhead signing installed in Seattle at the present time is illuminated. However, with 367 miles of modern mercury vapor lighting recently installed on arterial streets the reflectorized type of overhead signing is also being installed on an experimental basis. At the present time most of the overhead signs are installed on span wires across the street. This type of mounting has not been too satisfactory, as frequently there is a conflict with transit wires, guy wires, etc. The most recent installations of large overhead signs were made on mast arms mounted on wood or metal poles, which provide a more suitable type of support.

In the comprehensive overhead signing program contemplated by the Traffic Engineering Division, both metal and plywood overhead signs are being installed. Some of the signs will be illuminated, others will be reflectorized. The overhead signs will be mounted on sign bridges or on mast arms supported by either metal or wood standards. Several types of experimental installations at various locations throughout the city make possible a comprehensive evaluation and appraisal to determine which type of overhead sign is most suitable for installation on Seattle's Major Arterial Street System. Our studies to date indicate reflectorization is adequate for signs mounted twelve feet or less above the roadway where modern type mercury vapor lighting is installed.

● **LARGE paint rig is used primarily on double center line work. More than 20,000 gals. of paint are used annually.**

# SAFETY DEVICES
## *on the Garden State Parkway*

**Built-in safety devices that keep drivers on the road and block glare from lights have helped give the Garden State Parkway top place among safe-to-travel routes.**

A NATIONAL leader in superhighway safety since it first started full operation three years ago, the 173-mile Garden State Parkway, has behind that record a number of safety devices.

No one attempts to give those safety devices the full credit for the consistently low incidence of fatalities and accidents. The basic engineering design and the human element—including State Police patrol and law enforcement—are too obvious to ignore in any such consideration. But, on the other hand, the Parkway's various devices must rate considerable credit if only on the basis of motorist testimonials and reports.

For example, the unique "singing shoulder" which stretches some 25 miles along the extreme right edge

● **CENTER-ISLAND guard railing with vine covering to prevent contact between opposing traffic and deflect headlight glare is used along metropolitan sections.**

of the Parkway's northbound roadway in Monmouth and Middlesex Counties has been termed a lifesaver. Back in early 1955, the New Jersey Highway Authority—which built and operates all but three scattered State-owned sections of the Parkway—received a personal report to that effect from two New York motorists who had dozed while returning after a late work shift.

The "singing shoulder" is a strip of corrugated concrete which resounds when tires stray off the road and onto it. The resulting hum is loud enough to alert a driver to danger.

Another safety device or feature, now considered almost commonplace on major highways, is the white lining painted along the right and left edges of both Parkway roadways to delineate the pavement lanes at night or in fog. The lines—which consist of thousands of tiny glass beads imbedded in the white paint to reflect at night—have been showing the way to motorists ever since the Parkway opened. At that time, the Parkway was believed to be the first major highway using such white-line edges for any great extent.

One of the Parkway's built-in safety features is its wide center island or median strip dividing the northbound and southbound roadways. This divider measures up to 600 feet in width in some places; but in the heavily-populated metropolitan areas where right-of-way was necessarily limited, the Parkway adopted a safety device to provide an effective divider without the benefit of wide space. Guard railing—mainly comprised of sturdy wood slabs—has been erected along the center island in such narrow spots not only to keep traffic physically apart but also to eliminate headlight glare. A vine covering which blooms in the Summer adds further to the railing's effectiveness as a traffic divider and light deflector.

Another unique divider can be found in the State-owned section of the Parkway between U. S. Route 22 and the Raritan River. Here, the State Highway Department—which built and maintains the section—constructed an earthwork mound in the comparatively narrow center island to keep out opposing traffic and glaring headlights.

The New Jersey Highway Authority has another type of headlight glare interceptor on the Parkway's longest bridge—the 4,400-foot span across the Raritan River. The interceptors are glass-plastic boards set up on the central mall along the bridge to block out the glare of headlights.

But perhaps the best safety device on the Parkway involves human elements. Because of its complicated part-free part-toll character, the Parkway had to be designed as a barrier toll road. That is, toll collection booths were installed across the road at scattered intervals along the Parkway course.

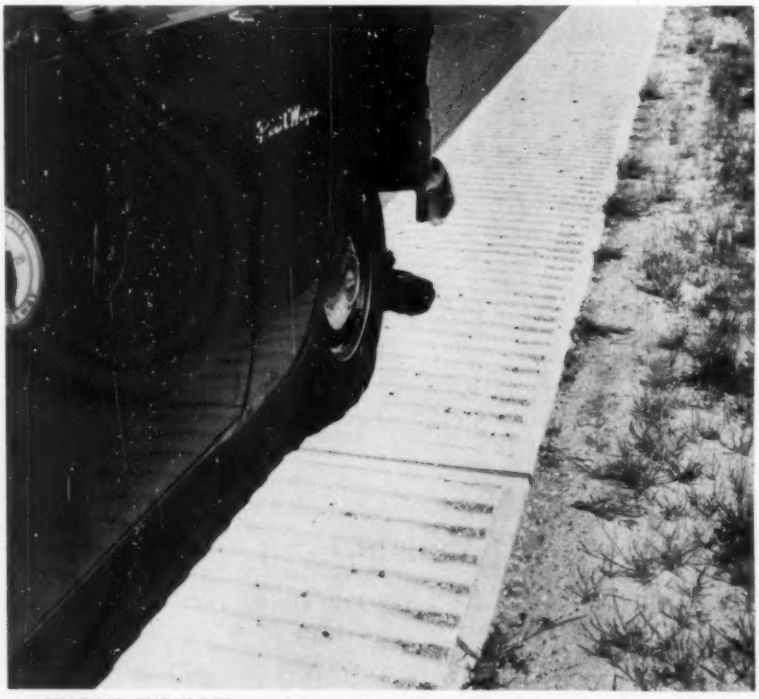
While they undoubtedly inconvenience drivers who want no interruption on an expressway, the forced stops to pay the toll are definitely life-saving devices. They afford motorists direct contact with toll attendants who can provide latest information on road conditions ahead—and they compel drivers to take a break in their long-distance travels. The brief pause can go far toward combating the highway hypnosis which comes from uninterrupted, long-distance travel. Many motorists recognize this benefit and have so told the Parkway officials.

To backstop the attendants at the toll booths, handy signs are posted in the windows facing the paying driver to advise of any special conditions ahead, such as fog, ice or what-have-you. State Police who patrol the Parkway 24 hours each day pass the word along to toll stations when such signs are deemed necessary. All the above devices must be effective. At least the Parkway's safety record during its first three full years of operation—1955, 1956 and 1957—would indicate that they were. In those years the Parkway fatality rate was 1.2, 1.3 and 1.3, respectively, per 100,000,000 vehicle miles of travel. This was the lowest along all major toll roads in the nation—and such superhighways annually led the conventional routes of the country in safety.

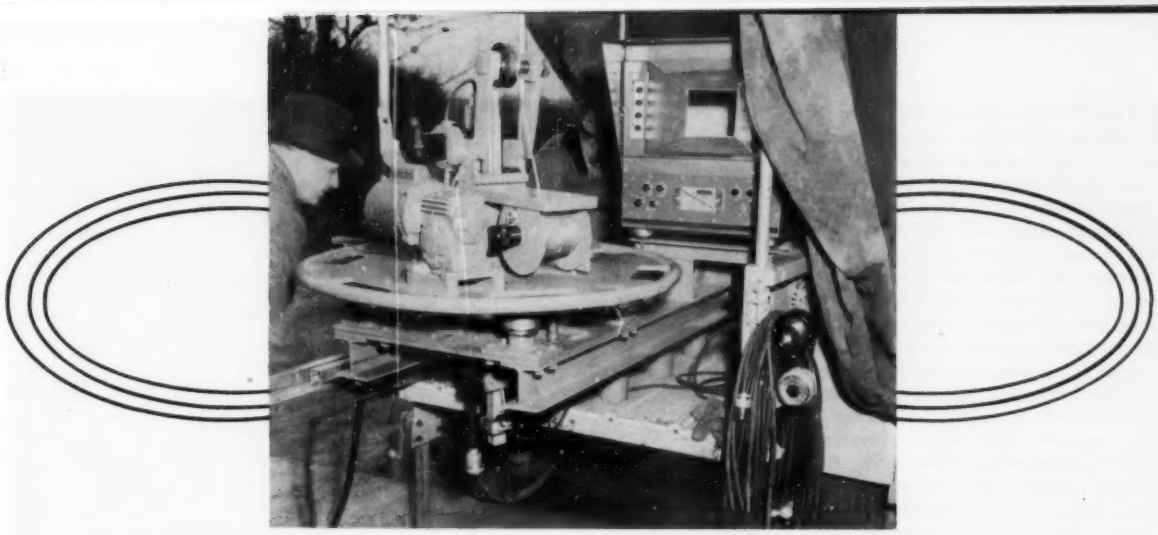
What is perhaps even more significant is the fact that Chairman Katharine E. White of the New Jersey Highway Authority, a woman boss, and her fellow Commissioners and staff are still looking for ways to improve safety devices or regulations. Witness the policy adopted last year of permitting motorists to stop anywhere along the roadside of the Parkway for a nap whenever they feel fatigued. Not only does the Authority permit such roadside naps, it actually extends a protective cushion. State Troopers patrolling the Parkway are asked to report such nappers to headquarters and to check on them during the snoring.

Further, the Authority is continually taking steps to improve its traffic and directional signing. Overhead signs on crossing bridges are being adopted to simplify communications and remove any possible hazards from reading.

The ultimate goal: a fatality rate of 0.0 and pleasure for all drivers.



● **SINGING SHOULDER—a close-up view. The strip of corrugated concrete gives an audible warning to automobile drivers whenever the tires stray off the pavement.**



● CLOSE-UP of equipment in trailer. Use of television permits reduction of inspecting crew; pictures expedite repairs.

# *Sewer Inspection by* CLOSED CIRCUIT TELEVISION

**ARTHUR D. CASTER,**
**Principal Sewage Disposal Engineer, Department of Public Works, Cincinnati, Ohio**

***This article is based on a paper presented at the 64th annual meeting of the American Public Works Association at Kansas City, Mo.***

THE BASIC principles of industrial television equipment are essentially those of television broadcasting, except that the broadcasting television transmitter is replaced by a direct metallic connection with the receiver. Thus the term "closed circuit television" is frequently used to describe such systems. Another very important difference between the two systems is the much greater simplicity of the industrial television camera and its accessories. In fact, it is this simplicity and convenience which are the major factors responsible for its many present and potential applications in industry, education, and commerce. Standardization facilitates the installation of a basic system, permitting easy extension as the necessity occurs. In most such situations, nothing need be discarded or replaced. It should also be noted that specially trained operators are not required for the normal operation of closed circuit television equipment. When the equipment is permanently mounted for continuous observation of the same process or area, operating adjustments are seldom necessary; if required, however, adjustments can be made easily either at the camera location itself or from a distant remote control point. Even changes in light intensity on the work scene are automatically compensated for by some equipment.

### *Justification of Use*

The City of Cincinnati has three sewage treatment plants and approximately fifty miles of interceptor sewers under the jurisdiction of the Sewage Disposal Section. On these interceptor sewers there are regulator chambers, diversion chambers, flood control chambers and the standard manholes. Some of these structures are built with reinforced concrete walls and contain such mechanical equipment as gate valves, float regulators, flood gates, slide gates, and adjustable weirs. The structures range in depth from 10 to 80 feet. Many are constructed without manhole ladders. Metal ladders rust, and in a short period of time may become accident hazards and not usable. Then the only means of access are by a specially constructed cage or by rope ladders.

The sewer system in and around Cincinnati is a combination of sanitary and storm sewers. After rains the material washed from the streets is brought into these control chambers and, if of sufficient volume, it will cause them to become inoperative. It is therefore continually necessary to inspect these structures to determine if they are functioning properly. Visual inspection would require a crew of three men, one man going down into the chamber while two remain at the surface in position for emergency rescue.

By use of the closed circuit television system the crew is reduced to the two men required to set up the equipment and operate it properly. No special equipment is necessary, the television camera is merely lowered into the area; and the inspection of the chamber is made on the television monitor. Likewise, while this inspection is being made, copper lines are run from the grease fittings of the mechanical units to the manhole entrance into the chamber to permit lubrication of the units. Serious defects found are reported, and a larger crew is dispatched to make the repair. The preliminary inspection of the damage makes it possible to familiarize the repair crew with the difficulty so that they will be properly prepared with needed equipment. On occasions it is necessary to record some conditions that were found in the regulators. Black and white stills and moving pictures are made of the monitor screen.

(*Continued on page* 174)

IN ANY city or village the need for and use of forms, in extent and complexity, must certainly depend upon the size and nature of the using organization. And, even though we assume a basic need for some kind of written or graphic record of inspection and repair at all levels, each municipality is influenced in this matter by the way in which they perform their work; their source of income and the control exercised by that source; reporting controls; and extent to which objectives of the maintenance organization are met by contracting the work.

Only minor construction of a repair nature is performed by the Peoria Street Department with the engineering department responsible for new construction. Street lighting is installed by engineering and primary maintenance is performed by the private utility company. Water service is provided and maintained by a private utility and the city sewer department maintains the sewers. Rubbish collection for the city is contracted to a local firm specializing in that field. Left to the street department is the two-fold job of performing the many maintenance and repair jobs not generally performed for profit by private enterprise and the exercise of control over that group of utility companies and other private persons making use of the public ways.

# Use of STREET MAINTENANCE INSPECTION FORMS

● COLOR is being used by an engineering aide to indicate those streets that will be given a dust oil treatment. Data will be transferred finally to the master map.

**LEONARD H. CARO,**
**Director of Streets and Sewers,**
**Peoria, Illinois**

Limited objectives permit organization of the department by type of work. A street maintenance division has two sections, one for the maintenance of paved streets and structures, and another for the maintenance of dirt streets and alleys. The cleaning division handles the sweeping and street flushing job, parks and boulevard maintenance, ditch and culvert patrol, weed cutting, street corner trash box pickup, and winter snow and ice control. Working personnel of the maintenance and cleaning divisions may perform their duties under a different foreman from one day to the next or in different seasons, depending upon the workload. The foremen, however, are strictly responsible for specific areas of work type. Their responsibility includes the assignment of men and equipment, requesting materials, layout of specific job tasks and the accomplishment of the larger assigned work programs. Excepting the larger work programs, these foremen perform most of the inspection for work to be done by their respective division or section. This is true to a limited extent for the bridge division, a one-task unit which operates the lift span on our bridge crossing the Illinois River. The bridge tenders must report damage incurred, but they do not make technical inspections to determine repair requirements.

The administrative division of the street department handles the overhead tasks of personnel, finance, reporting and material supply. Allocation of men and equipment to the divisions and the assignment of various tasks in overall programs to specific foremen responsibility is made by the superintendent of streets. But administration carries a specific workload as well. A street inspector supervises the city's refuse collection contract and the tree removal and trimming contract, as well as checking streets and alleys for nuisance violations of city ordinances. A clerk-stenographer receives and writes up citizen complaints, routes them to the responsible foreman or higher authority, and maintains a tickler file to check on the completion of each complaint. The superintendent of streets makes overall inspections of maintenance requirements and the proper completion of repairs which have been scheduled.

### *Director of Streets and Sewers*

Included in the administrative division is the position of the director

of streets and sewers. The director coordinates the maintenance activities of the street department, sewer department, the city's central garage and equipment pool, and the activities of those maintenance units with the work of other city departments. The director also budgets, lays out overall program work, writes and lets contracts and provides engineering support to the departmental effort. To assist in this job part time help is obtained from engineering students at Bradley University. One engineering aide works half time September through May making detailed inspection surveys of need, location, and extent of maintenance to be totally or partially performed by contract. He then reduces the accumulated information to proper tabular forms for inclusion in the coming seasonal contracts and to map form for the overall planning of the several programs which might otherwise conflict or duplicate maintenance efforts. In the construction season a second engineering aide is hired to assist in the supervision of contract work and to record progress and make a final report on work completed.

Of 65 persons in the street department, 8 have specific inspection responsibilities. The director of streets and sewers and the superintendent of streets make inspections of a general planning and supervisory nature, occasionally inspections of specific maintenance problems. The engineering aide makes technical and survey type inspections preliminary to program detailed planning for work usually performed by contract. The street inspector inspects for need of tree removal or trimming, then supervises the contractor doing the work. He supervises the rubbish collection contract to insure compliance on the part of the contractor and the citizen served with the conditions of the contract and the city ordinances. The four foremen provide the greatest amount of inspection, the day-to-day check for need and the follow-up check on work completed, each foreman generally inspecting maintenance requirements for his own divisional activity. To the department's clerk-stenographer falls the task of accumulating the work results into recognized standard units of man-hours, equipment hours and material used for the periodic reports required.

Only one full time inspector is available. Obviously, his activity is limited. Therefore, inspection is spread, by type of work and by the level in inspection performed, throughout the administrative and supervisory force available.

### *Types of Inspection*

In addition to the spread of inspection activities by type of work and level of responsibility, inspections might also be categorized in another manner: the condition of work involved.

An emergency condition report requires immediate action and gets it. Whatever information is available at the time is used to determine what men, materials and equipment to dispatch to the scene—not to inspect, but to repair the break, correct the problem or, at least, to protect the public from a hazardous condition. If the emergency is severe, a police radio will be available to call for more of anything required. A barricade and flares may be all that is needed for the present, to provide protection until later when department forces can be scheduled without taking them away from other jobs. Whichever the condition turns out to be, a false alarm or a serious matter, it is treated as if it were serious until known otherwise. No inspection forms are used as action is concurrent with inspection. A formal or informal report may be made afterward. The work itself will be reported in terms of standard reporting units as would any other job.

The citizen complaint is something else. No end is seen to the questions which might be asked, requests made and service required of a street department by the citizens who support it. Our experience reveals that most of the citizens calls represent legitimate claims for service. Whether the department can or should handle the problem, whether the complaint condition is a city or private responsibility, when we can or will take action, remains to be seen. An inspection must be made. A special form is used to enable the department to record the problem, assign the proper person to inspect, insure that inspection and recommendation were made, and determine that the problem was eliminated or the calling party contacted with an explanation of the situation. The complaint form used is flexible. It can be used to record any type of problem submitted by any person and assure attention to that problem.

The general patrol is another type of inspection. Performed by the director or superintendent it is usually an area survey or random sampling of overall city conditions. Performed by the street inspector or foremen the general patrol inspection constitutes an advance survey of routine maintenance work falling under their divisional responsibility. This general inspection may be recorded, in part, on complaint forms. Detailed information may be recorded for transfer to specific forms used for specific program work. Usually, however such notes as are taken are written on scratch pads as reminders for future detailed inspections or incorporation of deficiencies noted into routine maintenance schedules.

A large part of the street department work is organized on a program basis. Much of the program work is contracted. Because programming permits a greater maintenance yield from available resources, it merits greater attention and detailed planning. Because much of this work is contracted, inspections must be detailed and precise to provide exact bid quantities and reasonable guidance information for the successful bidder. Inspection for program work is specific and it is detailed. It is made well in advance of the work, a season, at least. It is usually performed by an engineering aide using a form designed for the particular type of work involved. Data gathered on the special form provides full information for the office planning, layout and scheduling of a program and a contract if that is used.

### *Example Forms*

The complaint form is the most versatile of street department forms. It can be used to report any condition. The calling party, his address and telephone number are recorded to provide for future reference or contact. The location of the problem is noted since the problem condition is not necessarily at the address of the complaining party. The citizen description of the problem is recorded for guidance of the inspector, while space is left at the bottom of the form for the inspector's recommended action by foreman or work crew. Date of receipt in the upper right hand corner can be compared with the date of inspection and date of action in the lower left corner. This time spread gives some indication of street department efficiency or workload. Initials indicate the receiver of the complaint, the inspector, and the responsible crew chief who performed the work to relieve the problem. The name of the foreman to whom the inspection or work is assigned is placed in the upper left corner along with the district in which work is to be performed.

In the usual case the complaint is received by telephone at the street department office. The caller provides the information needed by the clerk-stenographer, who records the details on forms in duplicate. By the nature of the work involved, an assignment is made to the responsible foreman with his name written atop the sheet along with the work district. The carbon copy is filed in a current file, the original given to the foreman for handling. When inspection and work have been completed the completed original form is returned, the carbon is thrown away, and the original copy is filed in the completed file. If work is not to be performed in response to the request, the requesting party is notified and given an explanation. This, too, is a completion of the complaint handling, and the returned original copy, so noted, can be placed in the completed file. Files are maintained for reference through the year following that in which the complaints were received. Then they are destroyed on the basis that any analysis of complaints is out-dated and specific information would probably have become difficult to recognize.

Much of the work of the department serves citizen complaints. Complaints fluctuate in kind and volume with the seasons, and most of the requests are satisfied by incorporating the work into programs which may be in an operating stage but have not reached the area of complaint. The form helps us follow through on legitimate service requests. It also serves in public relations by insuring that each citizen asking attention receives due consideration.

One of our contract maintenance programs is the oiling of gravel streets for dust control. Approximately 22 to 24 miles of street will receive this treatment every year. Preparation for the contract requires a detailed listing of each of some 250 street sections by name, location, length, width and oiling requirements. Most of these will remain the same from year to year; but some changes will occur, some streets will be eliminated from the program because of paving, new streets will be opened. For the detailed listing mentioned, the street and alley oiling program form is used. Streets and total requirements are grouped by work districts, with the streets listed in an order which might be followed to provide an orderly progression of work in the field.

The form itself is explanatory for its use mentioned above. Its flexible use, however, might be pointed out. This year's sheets, used for contract, as a checklist in supervising the contract, and as a record of work completed, may also be used as the inspector's checklist in preparing next year's program. Changes may be noted in the blank column at the right. Deletions may be noted by scratching out those streets which have been paved. New streets opened may be noted in the blank lines on the district sheet. A complete group of district listings is used by the maintenance foreman to schedule his grading and graveling which must precede the contractor's oiling. By keeping a running total of gallons of oil required for

● **FILE is maintained for complaint forms until original is returned with notation that suitable action is taken.**

streets reported graded and graveled, the contract supervisor can determine the earliest time at which a complete work day is available and insure the closest following of preparation with work completion.

By changing the date the form may be used from year to year. By altering gallons to tons the form is used for a salt compaction program on alleys. Using pounds in place of gallons it is used as an inspection form for the crack filling program. For whichever work program it is used, it also provides a reference for the making of planning maps and progress reports once the program is initiated.

The street inspection report form is strictly an inspection form, the basis for the original street oiling program detailed listing, and used to note the detailed information required to add newly opened gravel streets to the next annual program. Although its use is purely in the inspection phase, the street inspection report form is also flexible in that it may be used to inspect for several different types of work program on paved as well as gravel streets.

### *Routine Operation*

Certain departmental work lends itself to routine operation. Here much can be accomplished by detailed planning and scheduling. Such work is street sweeping with mechanical sweepers. We have 45 scheduled sweeping routes, formalized by numerical designation day and night, and written out in order of streets to be swept. Sweeping miles are premeasured for each point along the route so that the operator needs merely underline the last street on the route swept and record loads picked up. By handing in the route sheet with his daily time sheet, he makes his report as simple and effective as possible. Dispatch and check of work by the foreman is reduced to a minimum effort and maximum effectiveness. The problem in this kind of an operation is the change which occurs in street, parking and traffic patterns. If changes are drastic or rapid they are noted, taken into account, and routes are revised. Sometimes these changes occur gradually and the problems creep up unnoticed. The spread or change in street parking is one such problem. To help combat this we use a special form, the mechanical sweeping parking survey.

The sweeper operator carries the parking survey form with him on his regular sweeping run. When he has covered all routes he has noted those streets or sides of streets where more than 25 to 30 percent of the curb space is denied his cleaning efforts. Without the use of added personnel, approximately 320 curb miles of street are checked for parking periodically. Detailed inspection of the relatively few trouble spots can be checked to determine whether the problem of parked cars can be avoided by posting "no parking" signs ahead of the sweeper, changing the time of day or day of week for that section, or whether the problem is only a temporary one.

### *Producing and Designing Forms*

Mention has been made of the multi-purpose use of forms by the change of words or numbers on the form. This is possible because of our method of reproduction. We use a multilith machine which runs off copies from typed, printed and drawn on mats. The mats may be filed for repeat use, so only enough copies need be run for the fore-

seeable future use—large stocks are not necessary. Changes in the mat may be made by erasing to delete and typing, drawing or printing to add to the existing reproduction mat. Testing of forms on a small run basis or even the production and use of a form on a one-time use basis is practical.

Cards may be used and reproduced in the same manner for forms, but little use is made of this stock. It is more expensive, mechanically harder to handle, generally is too small to contain all desirable information, and usually requires special filing facilities. By using paper stock we avoid those disadvantages and still achieve desired handling qualities. Regular 8½ x 11-inch paper can be used in whole sheets or cut in half. It handles well in typewriters and files in standard drawers or looseleaf notebooks for reference. Sheets can be used loose or padded. Duplicate copies of completed forms are made.

Almost any of our forms can be produced and run off in a few hours. Designing the forms is a careful process if we expect to use it for more than a short time and a special purpose. Multi-purpose use is one aim. This reduces our file of mats and familiarizes personnel with the forms. Correlation of information is another objective. The information gathered on an inspection may serve more than one work program or one requirement for information. Simplicity is a third goal. We must have all of the information required, but when we require unnecessary information, or duplicate it, we reduce the capability of the form to guide inspection while increasing the work-load of the inspector. If we can make our forms fit the requirements stated, we reduce our files to a minimum. Inspection reports become action orders and records of work; or data from those inspection reports are transferred to program forms in a manner so that the original inspection forms may be thrown away, having served their purpose. Cumulative reporting of work completed further reduces the need for filing original inspection and data sheets.

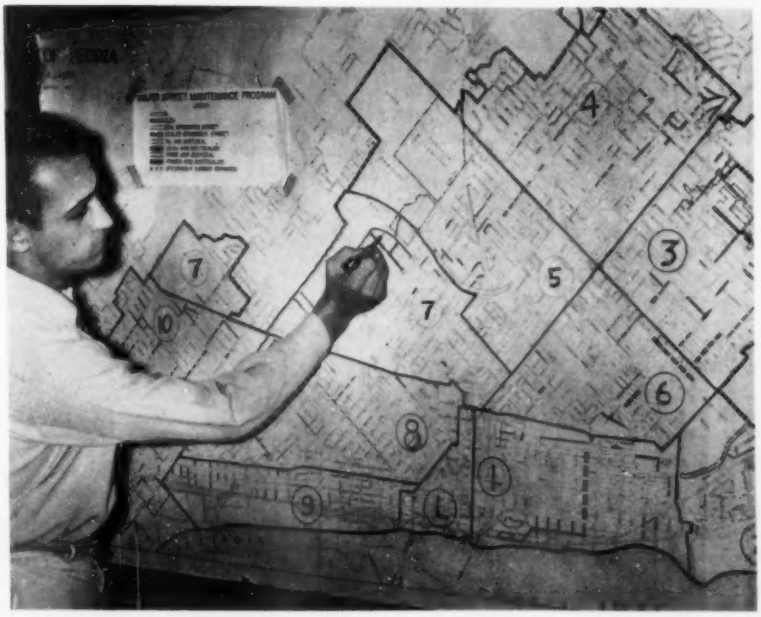
### *Maps*

The street department makes extensive use of city street maps, printed and available in reasonable quantity. Our maps are black on white, come in various sizes and show, as streets and alleys, all dedications whether opened to use or not.

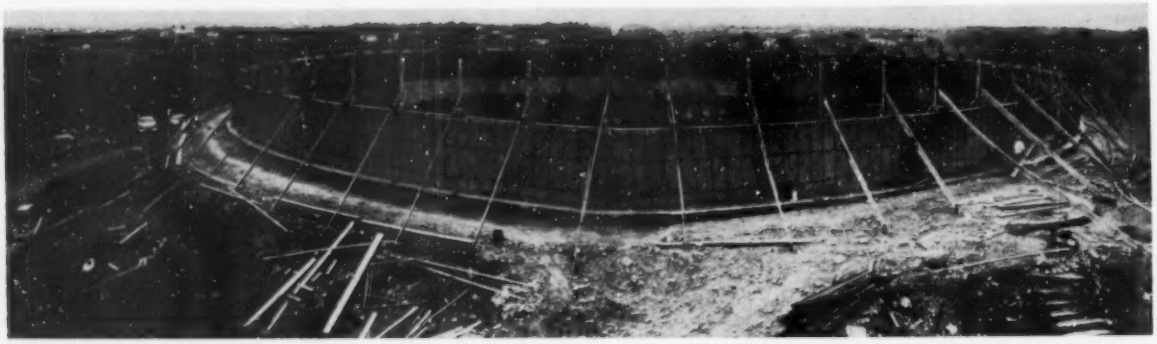
By various color fill-ins on the map we designate streets and alleys as unopened, vacated or by surface type. When one of these designations change, the correction is easily made. The record is simple and current. Since most of our program work is divided by surface type the reference is very useful. We check our grading and oiling schedule against the map record of gravel streets. In making mechanical sweeper scheduled routes we have easy reference to paved streets and can design to avoid the necessity of non-working travel over gravel streets. In considering the coming seasonal seal coat program we will use a blank map. From the base map we note all bituminous surface streets, and, noting them, outline those same streets in color on the blank map. We then have a field inspection map with which to survey those streets and determine which should be sealed next. The same procedure can be and is used for the crack filling program of bituminous and concrete streets.

Now, when the individual programs are mapped we can transfer them to a master planning map; each street where work is to be performed is outlined in a code color according to type of work to be done. Construction to be performed through the city engineering department is plotted, as well as known construction or openings to be performed by developers or utilities. By knowing what others will do, we can avoid grading and oiling a street which is to be paved, vacated or torn up right afterward. By correlating our own judgment of maintenance requirements we can avoid tarring a street which will be seal coated. We end up with a ready reference to the street department total programmed maintenance from which individual program schedules might be made more easily. Throughout the year, as work progresses on each program, the streets outlined are filled in to show work completion. This serves supervision and provides a current report of job status to the city manager or city council when they require such a report. At the end of the year a complete report of maintenance programs by street is filed with the one map.

One other record and inspection service is performed better by the use of maps than other means. On those bituminous and concrete streets requiring crack filling, we like to schedule attention every other year. When we plot those crack filled this year, we are reminded to inspect and attend those streets outlined but not filled in as having been completed. The priority for attention is maintained. The same use of maps is made for the seal coat program which is based upon sealing, where required, every five years. In mapping, this merely requires that the bituminous streets outlined are color-filled with a different color each year so that the sequence in inspection priority can be maintained.




● **STREETS to be seal-coated in the year's program are pointed out by Richard Evans, part time engineering aide. Colors indicate different maintenance programs.**



● DIAPHRAGM of 26-gauge sheet was used as a target for guniting and was left in the wall, see section on facing page.

# RESERVOIR WALL EXTENSION

## *Adds 10 Feet of Water Storage*

**CLIFFORD S. MANSFIELD,**
**Senior Engineer,**
**Fay, Spofford & Thorndike, Inc.,**
**Boston, Massachusetts**

A COMPREHENSIVE water system improvement has been underway in the city of Peabody, Mass., since 1956 (see PUBLIC WORKS, August, 1957) which to date, represents an investment of about $1.1 million.

Preliminary studies of the Peabody distribution system revealed the need for additional water storage facilities, a higher line pressure, some new water mains, and the feasibility of raising the water level in the existing 3-million gallon reservoir. Therefore, when a new reservoir was added at the far end of the distribution system, its overflow was set at an elevation 10 feet above that of the existing one.

Constructed in 1902 on a hill, the original reservoir had a concrete floor about six feet below ground level and walls of granite block masonry. Circular in shape (about 180 feet diameter), it had at the start of the recent program a capacity of 3 million gallons with a water depth of 16 feet. Three feet of freeboard brought the total depth to 19 feet.

The masonry wall had an effective thickness of eight feet at the bottom, sloping on the inside to only 34 inches at the capstone. The area around the structure was backfilled with rock, over which an impervious covering was placed.

From the start, it was evident that the existing structure was adequate to support an additional 10 feet of water. However, two problems were predominant, namely: 1) leakage through the joints in the existing masonry structure and 2) movement between the proposed wall and existing wall.

The leakage problem was solved by gunite lining the interior. Cleaned with an air-water blast to remove loose mortar and insure an adequate bond, the interior wall was lined with woven wire mesh and gunited. The concrete bottom being in excellent condition, a gunite cove was shot at the base of the wall for a bond to the floor.

The movement problem was not as simple. The existing masonry wall being over 50 years old, it was for all practical purposes considered immune to movement resulting from temperature changes and/or changes in water storage level. The proposed extension had to be either rigid masonry or an independent wall with a water-tight flexible joint between it and the existing masonry wall. Present-day construction costs eliminated the selection of a masonry wall extension. Besides, designs indicated possible changes of several inches in the circumference of the wall extension for various conditions of water level and temperature that would be difficult to provide in rigid construction.

The flexible wall extension, however, appeared to be a good idea and several designs were considered. The most economical approach—and one that would fulfill requirements for strength, flexibility, and watertightness—was adopted. It required the following steps: 1) Removing the granite block capstone from the existing masonry wall and replacing it with a reinforced concrete cap in which a rubber waterstop could be embedded and 2) constructing a prestressed concrete wall extension.

● CRAWLER tractor was used to pull the wire-winding rigs around the wall to be prestressed. Wire spacing varied with the depth from top, from 8 to 21 wires per ft.

The concrete cap replacing the granite-block capstone was poured in sections to eliminate shrinkage problems. Each 20 feet long and poured on 22-ft. centers, the sections were cured for seven days before the 2-ft. fillers were poured. Strength and bond were obtained by means of suitable keys and continuous reinforcing steel. At this point, a watertightness factor arose, to be overcome by embedding a continuous rubber waterstop in the poured concrete (see Fig. 1). Next, a series of rubber blocks 2-in. deep, 3-in. high, and 6-in. wide were placed on 3-ft. centers around the outside of this waterstop. Sponge rubber was placed between these blocks and also around the inside of the waterstop. The rubber blocks support the wall, and the sponge rubber keeps the flexible joint free from gunite during construction and from dirt during backfill operations.

As a target for guniting the extension, sections of 26-gage sheet were erected, overlapped at the edges, and held in a vertical position by wooden bracing and special dovetailed clips. Gunite was shot against the target until the thickness reached about three inches; the bracing was then removed and the inside face was shot.

After proper curing, the wall was ready for prestressing. The equipment used consisted of the following: 1) A wire-spacing rig that was mounted on top of the wall; 2) a movable carriage on which a brake-drum was mounted; and 3) a bulldozer to pull the rigs around the reservoir. In short, the plan was to spiral wrap cold-drawn high carbon steel wire around the wall extension with spacing as indicated in Fig. 2.

The design prestress was obtained by pulling the wire over the brake drum. To insure 105,000 psi working stress when in place, wire having a tensile strength of 140,000 psi was used. Control of the brake was manual, the operator setting it in accordance with dynamometer readings on the wire in place.

The two-wheeled wire-spacing rig was positioned on top of the wall and balanced upright by cables anchored in the center of the reservoir. Actual control of the spacing of the strands was achieved with a chainfall that was manipulated by a workman.

To start the wrapping, the contractor drove a ⅜-in. diameter lag bolt into the wall about 12 inches above the waterstop. As wrapping progressed, each strand was attached to the preceding one to prevent unwinding if the wire broke. A second type of clamping device was used to join the ends of the strands at the end of a reel.

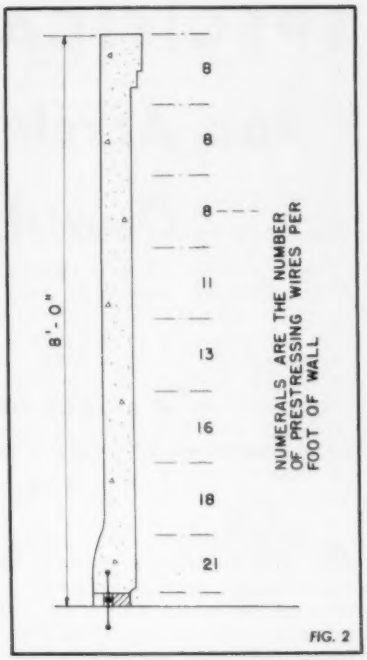


FIG. 2

● **NUMBER of wires per foot of wall.**

When the last wire was in place, it was clamped in seven places to the preceding strand while other clamps were removed to equalize the tension throughout the structure. A cover coat of one inch of gunite was shot over the nearly 11 miles of wrapping and was finished with a rubber float.

The design of the wall and the methods of construction and prestressing produced the anticipated results. Careful examination of the flexible joint after construction showed only a minute seepage of water which ceased before the backfill cover was placed.

Lateral measurements taken at quarter points indicated that the diameter of the wall decreased about ¾ inch as a result of the prestressing. About ¼ inch of this was recovered later when the reservoir was filled.

The construction required about four months to complete, during which the reservoir was dewatered and out of service less than one-half of the total period. The construction cost was $74,550. The engineering firm of Fay, Spofford, & Thorndike, Inc., Boston, Massachusetts, conceived, designed and supervised the work. National Gunite Corporation, Boston, Massachusetts, was the general contractor.

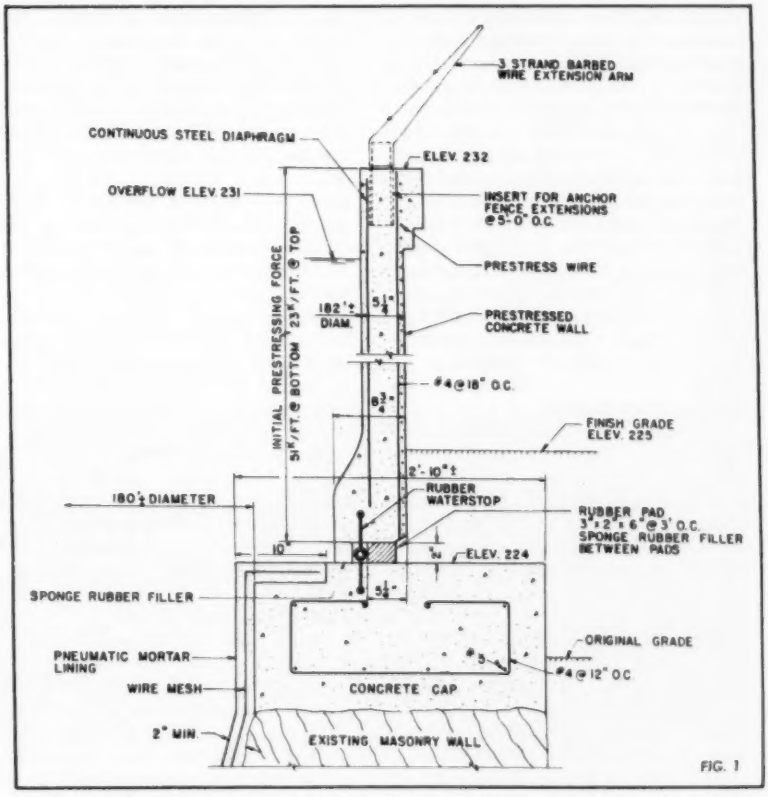


FIG. 1

● **CROSS-SECTION of prestressed wall, showing existing wall and concrete capping.**

# SPECIFICATIONS

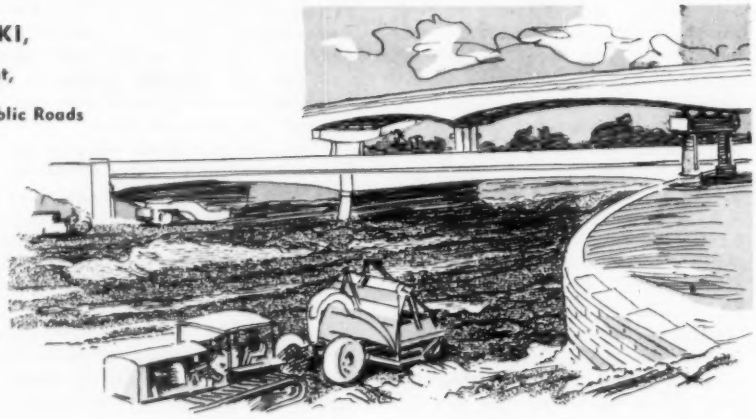
## *can Accelerate Production and Quality Control in the*

# HIGHWAY PROGRAM

**H. A. RADZIKOWSKI,**

**Office of Operations, Division of Development,**

**Bureau of Public Roads**



AMONG THE essential requirements to the tremendous highway program now in progress all over the Nation are two which are pertinent to this discussion. They are accelerated production and quality control. Highway contractors and highway officials—the partners in this gigantic joint venture—are sitting down together in an effort to reach a meeting of the minds over the rules of the game, the specifications for highway construction. The time is most propitious.

Such discussions are timely because the highway program has begun to accelerate. In 1958, capital expenditures by all governmental units for highway construction, including preliminary engineering and right-of-way costs rose to about $6.2 billion. This was $500 million more than was expended in 1957 and 3½ times the amount expended 10 years ago in 1948. Furthermore, it is anticipated that the program will be accelerated to higher levels of expenditures, reaching an estimated $8.1 billion by 1962.

During this initial acceleration of the highway program, both partners have observed the effectiveness of the specifications under which the joint venture has been carried out so far. As the conference table is approached in a cooperative spirit with mutual recognition of each other's responsibilities, improved specifications are beginning to benefit the highway program in accelerated production with adequate quality control.

In order for individuals or groups to reach a meeting of the minds, there must be a medium of communication that is understood by both. In this country we have such a medium called the English language. Highway officials use this medium in their specifications to communicate to the contractor how work is to be performed. Are these directions understood? Usually, yes. But sometimes the terminology makes the intent not so clear as it might be. Differences in terminology between specifications often lead to confusion and misunderstanding.

To illustrate the point, five State specifications were taken at random from the bookshelf. All were current, having been revised in 1957 or 1958. In each case, these specifications begin with a definition of terms. Here are the definitions we find for these terms:

*Sub-Base:* No. 1—See definition of "Subgrade". No. 2—None. No. 3—None. No. 4—An intermediate course of processed or selected material placed upon the earth grade beneath a base course. No. 5—Materials placed immediately above the subgrade to provide required stability.

*Subgrade:* No. 1—That portion of the roadbed upon which the base course or the surface course including curb and gutter are to be placed. When referring to grading operations, it is that portion of the roadway upon which the subbase is to be placed when subbase is required. No. 2—That portion of the roadbed prepared as a foundation for the subbase, base, and surface courses. No. 3—The surface of the roadbed. No. 4—The surface of the earth grade, subbase course, or base course, as the case may be, upon which the subbase course, base course, or surface course is to be placed. No. 5—The portion of the roadbed prepared as a foundation for the subbase, base and surface courses.

Clearly, there is lack of uniformity in these definitions. Furthermore, compare them with the American Association of State Highway Officials recommended Specifications for General Provisions in highway construction contracts. There these terms are defined as follows: Sub-base: Materials placed immediately below the subgrade to give it the required stability. Subgrade: The portion of the roadbed prepared as a foundation for the base and surface courses.

Again you will note the lack of conformity with the definitions recommended by AASHO. Were the recommended definitions arbitrarily put forth? Let us look into the background. One of the Operating Committees of the Committee on Standards, AASHO, is the Committee on

Construction. This Committee by letter ballot approved a draft of Specifications for General Provisions in 1948. At the annual AASHO meeting that year it was voted to send these proposed specifications to the Associated General Contractors of America and the American Road Builders' Association for review and comments.

In addition, these specifications were cleared by the AASHO Committees on Bridges and on Nomenclature. After revisions based on comments from these groups, the specifications were approved by the Committee on Construction, the Committee on Standards and the Executive Committee of the AASHO after which they were approved by a majority of State Highway Departments before being published for general use.

The members of these AASHO Committees are top level highway officials in the country. They are appointed to these committees usually because of specialized experience and knowledge in the area for which their committee has responsibility. The American Road Builders' Association and the Associated General Contractors of America are national associations representing large groups of highway contractors and other segments of the highway industry. You must grant, therefore, that these specifications are not arbitrary. They were developed after long and careful deliberation of the best qualified men in the Nation who have intimate experience and knowledge of their subject.

These experts recognize and so state in introducing these Specifications for General Provisions that it would be impossible to write detailed specifications which would be suitable for use throughout the country without change. They do urge, however, that the wording of the recommended specifications be used wherever and whenever practicable with such changes and insertion of details as may be necessary to adapt them to local conditions.

It would appear desirable that there be more uniformity in the definition of these terms in highway construction specifications. Or, what is more to the point in our present discussion, how does such lack of uniformity affect the rate and quality of highway construction?

### *Lack of Uniformity*

These two definitions were compared solely to show as simply as possible that a lack of uniformity does exist between highway specifications as well as a lack of conformity with recommended standards of good practice. A great deal of effort has been devoted down through the years to developing and keeping current these standards of good practice.

There are two primary reasons why busy highway officials were willing to make this effort to develop these standards. First by making them available as guides to state, county and local officials, high quality in highway construction was encouraged. For, as we have seen, these recommended standards are deeply rooted in research and experience which constitute the only sound basis for determining how highways should be built.

Secondly, the development of these standards should encourage greater uniformity in highway construction methods, equipment, materials and practices. Greater uniformity would benefit the highway program in many ways. It would give contractors and their personnel an opportunity to become thoroughly familiar with a uniform set of highway construction requirements. They could develop equipment and methods which would do the work most expeditiously and economically, knowing that the same could be used on other projects regardless of the jurisdiction. Bid prices would go down because of greater efficiency on the job. Uniformity would foster an accelerated rate of construction and improved quality in the results.

### *Coarse Aggregate*

There are many areas in which greater uniformity is feasible. One of the most important highway materials is coarse aggregate. In 1948, the National Bureau of Standards published, "Simplified Practice Recommendation R-168" which proposed standard gradations and sizes for coarse aggregates. Among those accepting these standards were 33 State highway departments, some of the more important construction agencies of the Federal government including the Bureau of Public Roads and several hundred commercial producers.

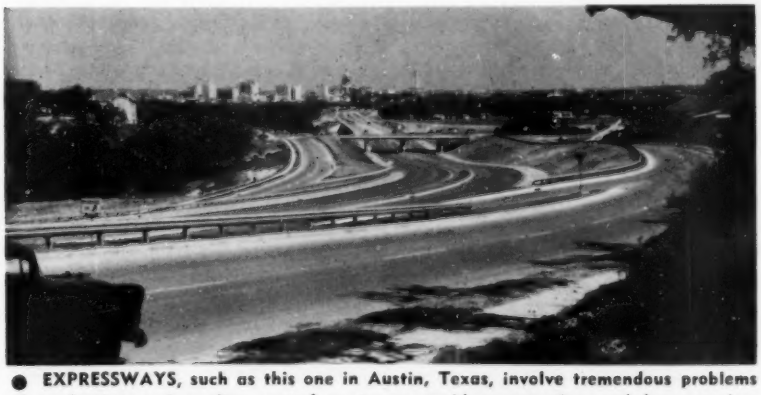
The following year, the AASHO Standard Specifications for Standard Sizes of Coarse Aggregates for Highway Construction (M 43-49) were adopted. These conformed with a minor exception to the Simplified Practices Recommendations. At least two-thirds of the States again voted approval of the sizes and gradation ranges in these standards.

Only eight States have adopted these standards in their specifications for concrete paving. Four States conform to a major extent in these specifications for bituminous paving.

These standards were developed because of the economies that are inherent in this type of simplification. The producer and supplier has less capital tied up in stock, in machinery and in storage facilities. There is less likelihood of misunderstanding and error because there are fewer sizes and grades. They could ship across State, county and local lines without the difficulty that is now experienced. Production and handling costs would also be reduced.

The consumers also would benefit. Lower overhead, production and handling costs would mean lower cost for coarse aggregate to the highway contractor. At least part of these savings would be passed along to make the highway construction dollar go farther. There would be less likelihood of slow delivery resulting in delays in construction. Time would be saved in inspection and testing.

In order to develop the full benefit from uniformity in size and



● **EXPRESSWAYS, such as this one in Austin, Texas, involve tremendous problems of production and quality control to insure rapid construction and long service.**

gradation of coarse aggregates, however, there must be wide acceptance and use of acceptable standards throughout the highway industry and in highway specifications. The nineteen sizes and the range in gradations should be adequate for practically any purpose and condition encountered in highway construction. These sizes and gradations are used in AASHO standard specifications for surface and base courses of various types. These specifications also were approved by the State highway departments before they were adopted.

Another area where greater uniformity would benefit the highway program is in requirements for the mixing time for concrete. Research has shown that mixing beyond 60 seconds is not warranted by any improvement in the quality of concrete. Current specifications, however, require mixing times for concrete in 27E or 34E dual drum pavers that range from 50 to 120 seconds.

### Concrete Forms

Requirements for forms for concrete paving also vary. Although the width of base is usually required to be not less than 8 ins. with a 1:1 ratio between width of base and height, the thickness of the steel used in fabricating the form is different in different States. Some require not less than three-sixteenths of an inch thickness, others require not less than seven-thirty-seconds of an inch, one specifies a minimum of one-fourth of an inch and others have no requirement. Curb and gutter forms vary, too. One contractor reported recently that on a paving project which passed through three different jurisdictions he was required to furnish and use three different types of curb and gutter forms.

There are also variations in the specifications for bituminous paving besides in respect to the size and gradation of aggregates. Some of these affect production. For example, many highway departments limit the forward speed of bituminous pavers to secure initial compaction as the material is spread. Other highway departments have eliminated these speed limitations in order to take advantage of new equipment that is now available. This new equipment has put down bituminous concrete at speeds up to 65 fpm. Immediately after the material is spread at these rates, it is compacted with pneumatic rollers. Steel wheeled rollers are then used to finish the surface. Densities equal to or better than required by the specifications are readily obtained.

Another new equipment unit which should expedite concrete paving is the slip-form paver. At least one State highway department specification has been revised to permit the use of this equipment. In addition, the AASHO Specifications for Concrete Pavement Construction, 1958 edition which is now available, contains provisions covering the use of the slip-form paver. The elimination of forms should substantially expedite concrete paving operations. An attachment has been developed which facilitates the placement of wire reinforcing mesh thereby further increasing the utility of this machine.

### Compaction

This expanded highway program will require moving and placing more earth per mile of road than ever before on highway construction. There is a corresponding increase in the importance of securing stable embankments for these new roads. Current highway specifications usually require that the material be compacted at optimum moisture content to a percentage of maximum density. Test procedures, however, for determining optimum moisture content and maximum density vary. They include the standard AASHO, the modified AASHO, the Proctor and the California impact test procedures. It has been shown[1] that these procedures do not give the same results for moisture and density for the same material. Here again the adoption of a uniform standard might help eliminate uncertainties on construction projects.

In connection with the compaction of embankments, a fast, reliable method of determining density and moisture content in the field would help expedite this operation. Nuclear methods of making these determinations appear promising and progress is being made in improving the equipment and instrumentation. Perfection of this method would help accelerate the rate of construction and insure high quality in the work.

Another area which should be reviewed is in connection with requirements for bituminous surfaces. Variations in the speed of pavers and in gradation of aggregates were mentioned earlier. As a basis for design and construction of flexible pavement for the AASHO Road Test, a questionnaire was sent to State highway departments concerning their practices in the use of bituminous concrete. In regard to roller equipment, 16 specified either tandem or three-wheel rollers, 16 require a minimum of one tandem and one three-wheel roller and 11 allow only tandem. Only 6 permitted the use of pneumatic tired rollers.

Twenty-one highway departments specified maximum roller speeds, ranging from 1.5 to 3.0 mph. Twenty-seven specified the maximum number of tons that could be placed per hour per roller. This varied from 25 to 150 tons. Six more had similar requirements on a square yard basis, ranging from 200 to 500 sq. yds. per hour per roller. There were also many variations in density requirements, surface smoothness tolerances and other factors.

### Where Uniformity Helps

These are a few of the areas in current specifications which it would be well to review. Greater uniformity and conformity to recommended standards established through AASHO procedures would help accelerate the highway program, effect economies and insure high quality. Uniformity would aid the contractor, the highway material supplier and the equipment manufacturer in crossing State, county and city lines. Their operations would become more economical and part of these savings could be converted into more miles of highway that are so badly needed.

Highway departments across the Nation are due a great deal of credit for their all out effort to keep this tremendous program on schedule. They have overcome many difficult problems in this accomplishment. They have increased the productivity of their engineers through the integration into these operations of the electronic computer, new photogrammetric equipment and techniques, radio and a score of other more efficient methods and equipment. On construction projects, they have opened the door to new ideas in equipment, materials and methods in many instances. Many of these innovations have aided the other members of the team in discharging their responsibilities. They can help further by a continuing effort to review specifications in the light of new developments in materials, equipment and methods with our long-range objective in mind: The increased production of high quality highways to serve the Nation.

[1] "Maximum Density and Optimum Moisture in Soils", F. N. Hveem, *Highway Research Board Bulletin No. 159.*

● CRAWLER compacting steep face of landfill in Baltimore Co., Md. This is difficult but essential for good operation.

# Operation of Sanitary Landfills *by Counties*

ON A questionnaire sent to county engineers and county highway superintendents throughout the United States in 1958, information was requested concerning refuse disposal operations. Questions asked were how the operation was financed, equipment used, whether collection equipment was county owned, the charge at the landfill and the number of new landfills planned. The Editors of PUBLIC WORKS Magazine have compiled some of the data returned on the questionnaire.

C. L. Leavitt, Pinal County Engr., Arizona, said the landfill method of disposal was used and this was financed through taxes. A bulldozer and a power shovel were used at the fill.

Following are the answers from California Counties: S. M. Black, Director of Public Works, Fresno County, stated their fills are operated through scavenger rights. R. C. Downer, El Dorado County Road Commissioner, said money from the General Fund is used to run the landfill operation and that a D6 dozer is used at the fill. Office Manager, T. J. McGee, Humboldt County, stated that they use loaders and the operation is financed through General Funds. Kings County Road Commissioner G. C. Potter stated they use a dozer and the Health Dept. finances the operation. Madera County uses a dozer and loader, finances its operation through the General Fund and is planning two new fills according to Road Commissioner J. B. Hughes. H. A. Bell, Road Commissioner, Mariposa County, said a tractor is used in their landfill operation which is financed by County Funds. F. C. Carner, Mono County Road Commissioner said landfills are financed through county taxes and a dozer and dump trucks are used. Sales tax money finances the landfills in Monterey County; equipment consists of a dozer; and they are planning two new fills according to Road Commissioner C. Dudley. A. E. Newcomb, Adm. Engr., Riverside County, answered that their operation is financed through the General Fund, they use D4, D7 and D8 dozers and are planning three new fills.

Asst. Road Commissioner W. Carris, San Bernardino County, stated that they use a bulldozer, a carryall and a dragline, and the operation is financed by County property tax; they are planning three new fills. San Diego County Road Commissioner J. H. Mack is also planning three new fills and present landfill operations are financed through regular taxes; they use dozers and scrapers at the fills. L. H. Bradley, Director of Public Works, San Joaquin County, answered that they financed their fills through the General Tax Rolls, use bulldozers at the fill and are planning one new fill. Santa Barbara County makes a charge to the patrons; bulldozers are used at the fills, stated F. E. Evans, County Surveyor. Two 35-hp dozers are used in the Shasta County fills and two new fills are contemplated according to E. D. Breuning, Director of Public Works. Fills in Sonoma County are operated from the County Budget and by charges on a cubic yard basis; bulldozers are the equipment used; M. M. Wallace is County Surveyor and Road Commissioner. C. B. Hendricks, Tehama County Road Commissioner, said that they use tractors and motor graders and the operations are financed by money from the General Fund. In Tulare County, J. Garcia, Road Commissioner, reported that a TD9 with a 4-1 bucket is used at the fills which are financed by the General Fund with one new fill being planned.

W. D. Pettee, Highway Coordinator, Denver County, Colo., answered that their fills are financed by funds from General Revenues, that they have a bulldozer and 35 compactor trucks as equipment and are planning approximately seven new fills. In Jefferson County, Colo., the county finances the fills, using a dozer, dragline and private trucks as

● **OPERATIONS for sanitary landfill in Riverside Co., Calif., are financed from the general fund. Three tractor-dozer units are used. Three new fills are planned.**

equipment; P. H. Norris is County Engr. A dozer and a pick-up truck are used at the fills in Larimer County, Colo., and the fills are financed by the County, according to W. W. Campton, County Engr.

The following paragraph covers answers submitted from County Engineers and Officials of Florida: Alachua County Engineer R. J. Miller, said that they use tax money and a TD-14 dozer is used at the fills. B. B. Nichol, Jr., Bay County Engineer, said they use a Drott Bull Clam, the operations are financed by taxes and they are planning two new fills. County funds pay for the operation and tractors are used at the fills, reported C. P. Goodson, Lake County Engr. Money comes from the Road-Bridge Fund and a dragline and dozer are the equipment used, stated E. J. Bradshaw, Leon County Road Supt. C. M. Brakefield, Jr., Marion County Engr., said they are planning six new fills; their present fills are financed through the Road-Bridge Fund and bulldozers are the equipment used. Palm Beach County uses money from the Mosquito Control Dept. and charges by the load; they use four dozers, a dragline and two pumps at the fills with two new fills being planned according to A. A. Weybrecht, Supt., Roads and Bridges. L. O. Hester, Pinellas County Engineer, said they charge the users by the ton; a dragline and dozers are used at the fill. Five new fills are being planned in St. Johns County; present operation is financed through the General Fund and the equipment consists of a dozer and a truck; L. N. Jones is County Engr. Sarasota County Engr., J. Grout, said they have a service charge per the load, use TD-14 dozers and are planning one new fill.

W. Fitzgerald, Director of Public Works, Dekalb County, Ga., said that their landfill operations are financed through taxes, that they use a dragline and bull-clam and are planning one new fill. Landfills in Glynn County, Ga., are financed by taxes and the equipment consists of bulldozers and five Packmasters reports D. C. McCaskill, County Engineer. County Engineer, T. H. Little, Ware County, Ga., said they are planning two new fills; their present fills are financed through public funds and they use a Bull Clam.

J. E. Painter, Booneville County Engr., Idaho, stated they are planning a new fill, that the present operation is financed by a levy and that they use a tractor and a dozer. A D7 dozer is the equipment and the money comes from the Road Fund said D. C. McClary, Shoshone County Surveyor and Engineer, Idaho.

A service charge of $1.20 per ton and equipment consisting of a ¾-yd. dragline and a D6 high lift are reported by O. B. Dold, Supt. of Highways, Du Page County, Illinois.

R. E. Helms, County Engineer, Chickasaw County, Ia., said they use a patrol and dozer at their landfills. C. K. Paulson, Hancock County Engineer, said that two towns finance the operation and a dozer is used at the fill. Cerro Gordo County, Iowa, has a Traxcavator and six collection trucks and finance their landfills through taxes according to C. G. Brown, Director of Public Works.

J. H. Robertson, County Engineer, Pawnee County, Kans., said that the city financed the landfill and a dozer is used at the fill. Six new fills are being planned by Rush County, Kans., and the present operation is financed by the Road-Bridge Equipment Fund; the equipment consists of a dozer.

General Road Funds are used to finance the operation and a bulldozer is used on the fill said L. T. Shepherd, County Road Engineer, Clark County, Ky. L. A. Whitmer, County Road Engineer, Fayette County, Ky., said they have a charge of $1 per load of refuse and additional funds are available from the County Road Fund. Their equipment consists of a D7 dozer and dump trucks.

● **SPREADING cover material at the Milwaukee Co., Wisconsin, landfill. Charges for disposal are made on the load basis. An additional landfill is contemplated.**

W. P. Williams, Sec.-Treas., Grant Parish, La., answered by saying that their landfills are financed by monthly payments by towns and the equipment consists of a truck and dozer. F. M. Poche, Parish Engineer, St. Bernard Parish, La., stated they use a bulldozer and four packer body trucks in their landfill operations.

R. J. Hajzyk, Chief, Bureau of Operations, Baltimore County, Md., said they finance their landfills by taxes and by a charge per load; shovels and bulldozers are used at the fills. Harford County, Md., is planning a new fill; it finances the present operations by a levy and uses dozers and loaders at the fill; L. J. Waldenberger is County Highway Engineer, M. A. Butcher, Director of Public Works, Montgomery County, Md., said they have a charge of $2 per load at the fill and their equipment consists of bulldozers. Two new fills are planned.

In Clare County, Mich., Thomas Cook, Supt., reported the townships financed the fills; a dozer and trucks are used to operate them. E. F. Rogers, Engr.-Mgr., Huron County, stated that the landfill operation is financed through the state and county park fund and they have a dozer and a packer loader.

G. L. Stone, Chief Engr., Jackson County, Mo., said that the operation is financed by the Maintenance Dept. They use a dozer and containers in the operation of the fills.

A County tax is used to pay for the operation; for fill operation a dozer and scraper are used reported H. B. Bouton, Lake County Surveyor, Mont. V. R. Petersen, Missoula County Engineer, Mont., said taxes from the road fund are used to run the fills and the equipment consists of a dozer and grader. The landfills are financed through taxation and a loader comprises the equipment according to G. D. McCarthy, County Engr., Silver Bow County, Mont.

E. S. Swindell, County Manager, Durham County, N. C., said they use a TD-14 crawler tractor with a Bull Clam in their sanitary fill operations.

R. F. Koerner, Chief Engr. Constr., Franklin County, Ohio, said they charge by the cu. yd. at the fill, and their equipment includes a dragline, high lift, bulldozer and packer trucks. Also, they are planning one new fill.

Money from the Road Fund is used to finance operations using dozers according to G. H. McAllister, Roadmaster, Deschutes County, Oregon. R. H. Pearson, Office Manager, Umatilla County, Oregon, said that money from the County Health Fund is used to operate the landfills; dozers are used at the fill site. A D7 dozer is the equipment used, while money comes from the Road Dept. reported V. H. Russell, County Engr., Wallowa County, Oregon.

F. K. Remy, County Engineer, Delaware County, Penna., said that a Bond issue and a charge of $3.25 per ton finances their landfill operations. Also they are planning two new fills.

Courtesy International Harvester

● **ORANGE Co., Calif., has eight sanitary landfills at present. Shown above is La Harbour, where the fill will eventually be about 80 ft. deep. The cover material must be excavated from the bottom of the ravine, using tractor-scraper teams. Another tractor compacts refuse.**

Money from the General Fund for operation, and a crawler tractor for equipment, with one new fill planned were reported by R. A. Curtis, Highway Supt., Lawrence County, S. Dak.

C. T. Klein, County Highway Engr., Knox County, Tenn., and H. M. Shannon, Jr., Supervisor, Morgan County, Tenn., both said they use a dozer in their landfill operations.

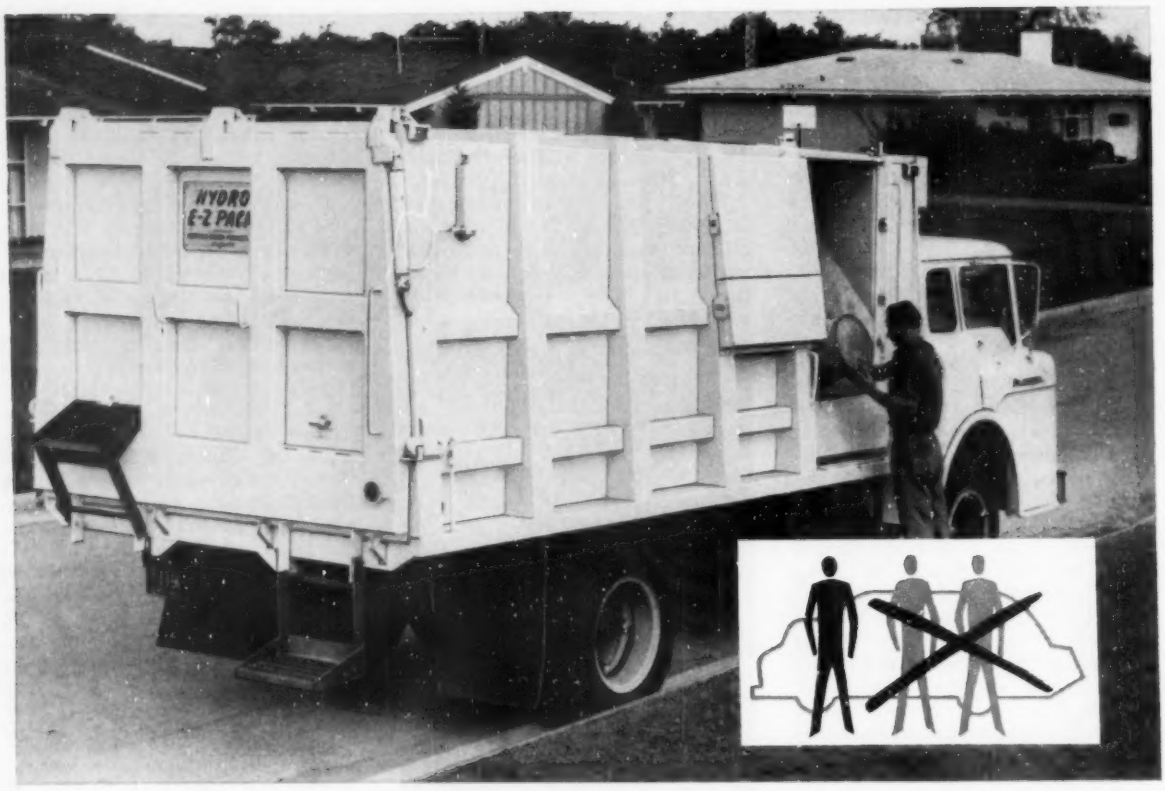
The following data came from counties in Texas: W. P. Schulze, Assistant County Road Engr., Bexar County, said their equipment consists of a dozer and tractor. Gravel pits are used as disposal areas with a bulldozer for operation according to R. H. Clinger, Dallas County Engineer. S. L. Kucherka, Jr., Drainage Engr., Ft. Bend County, said their operations are financed by regular operating funds and their equipment consists of shovels and a dragline. A dozer and a grader are the equipment used at the Marion County fill site; T. Morris is County Judge. D. L. Hogan, Waller County Engr., reported use of trucks and a dragline, with operation financed by money from the County Road Dept. Dump trucks are used in Webb County, said E. J. Foster, County Engr.

H. J. Tippetts, County Surveyor, Davis County, Utah, said that their operations are financed by money from the General Fund and the equipment used at the fill sites include a dragline and dozers.

Chesterfield County, Va., uses money from the General Fund, owning two trucks and renting their other equipment; R. A. Painter is County Engineer. C. W. Porter, Director of Public Works, Fairfax County, Va., said they use tax money and make a charge at the fill; equipment consists of dozers, trucks and backhoes. Bulldozers, a dragline and five packer trucks are used in Henrico County, Va., C. P. Richardson, Assistant Road Supt. P. B. Matthews, Roanoke County Engineer, Va., said they finance their operations from money from the General Fund and have a TD-9 dozer and three packers as equipment.

The following are answers from counties in the state of Washington: H. D. Martin, Cowlitz County Road Engineer, said they get money from the Health Dept. and from property taxes, use a dozer at the fill site and are planning a new landfill. County Funds support the operation of the fills and a dozer is used, said Pat Thomson, Douglas County Engineer. G. H. Norris, Island County Engineer, stated that their fills are a county-city operation and the equipment used is a grader. Jefferson County finances its fills by taxes, use bulldozers in their operation and are planning one new fill; R. Wilder is County Engineer; I. W. Pouttu, Pacific County Engineer, said their fills are a city-county operation and their equipment consists of a dozer and grader. Pierce County uses a tractor on their fills; R. P. Ryker is Assistant County Road Engineer. W. S. Genther, Assistant County Road Engineer, Skagit County, said they use money from the Public Health Fund, have a dozer and are planning one new fill. Township taxes support fills in Whatcom County and a dozer does the work; J. T. Lay is County Engineer.

S. N. Brickhouse, Design Engineer, Milwaukee County, Wis., said they charge by the load, use a bulldozer at the fill site and are planning one new fill.




# Are you wasting $8,000 per truck per year

## by not having HYDRO E-Z PACK on the job?

You get one-man operation in practically every waste disposal situation with Hydro E-Z Pack disposal units. Because E-Z Pack takes everything, compacts it better, and hauls more, you cover the route faster, pack the load en route, make fewer trips to the dump. No need to break down cartons, trash and tree limbs because of E-Z Pack's wide openings.

You get other cost-cutting advantages, too. E-Z Pack requires a smaller, less expensive chassis than most units; has lower maintenance costs, is the fastest unloader in the field. Add these all together and you can be saving up to $8,000 or more per truck per year.

Are you making money on waste . . . or wasting money you could be making? Ask for a Hydro E-Z Pack demonstration on your toughest route–and analysis of your waste disposal operation. We'll send a free copy of "The Big Squeeze," too. (No obligation, of course.)

### USERS' REPORTS

Here are excerpts from letters showing what Hydro E-Z Pack has done for a few users:

**H.W.J., City Manager, Florida:**
"We haul in one E-Z Pack load what formerly required seven large open truck loads."

**C.J.M., Waste Paper Co., Ohio:**
"Handles with ease what we formerly loaded in 32-foot van body. One E-Z Pack load equals four 14-foot stake body loads. In reducing bulk, has no competitor."

**C.E.C., Disposal Co., Illinois:**
"On one account for one month, we made 34 loads where we made 102 loads previously; saved on mileage, gas, oil, truck and tire wear, labor; came up with actual monthly savings of $227.20 on this one account alone. Figure one E-Z Pack replaces three other-type units."

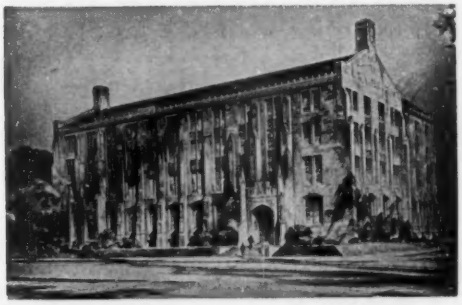
**Two-City Comparison (California)**
22,000 dwelling units
9 men—9 E-Z Packs
22,000 dwelling units
42 men—2 garbage trucks,
12 rear-loader packers.

Hydro E-Z PACK

# HYDRO E-Z PACK

HYDRO E-Z PACK DIVISION OF HERCULES GALION PRODUCTS, INC., DEPT. PW-259, GALION, OHIO

# News BULLETINS



AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

## 1959 Nichols Award Committee

Chicago, Ill.—President Hurst has announced the appointment of Morris Cohn, Editor, *Wastes Engineering*, as Chairman of the 1959 Charles Walter Nichols Award Committee. Serving his second year as a member of the Committee is Hugo Erickson, formerly City Engineer, Minneapolis, and now a partner in an architectural firm in that city. Newly appointed to a 3-year term on the committee is Samuel Baxter, Water Commissioner, Philadelphia.

The Charles Walter Nichols Award is presented annually to recognize outstanding and meritorious achievement in the sanitation phase of the public works field. It consists of an honorarium of $500 and a scroll describing the achievement. Candidates for the Award may be nominated by an APWA Chapter or by an individual active member of the Association. The basis of the Award is a paper or description of an operation, administration of a function, or the design of equipment or a facility which reveals originality of thought and aggressiveness of execution by the candidate. The idea developed or designed must have been put to practical use within the governmental unit in which the candidate is employed.

## Albert J. Marrara Appointed To ASTM Committee C-9

Chicago, Ill.—Albert J. Marrara, Construction Engineer, Department of Streets, Bureau of Highways, City of Philadelphia, has been selected to represent APWA on the American Society of Testing Materials' Committee C-9, "Concrete and Concrete Aggregates". Mr. Marrara replaces Julius Adler who resigned recently after more than twenty years of service on the Committee. Mr. Adler is a Consulting Engineer with offices in Philadelphia. He is a life member of the APWA.

## Southeastern Public Works Conference To Be Held At Gatlinburg, Tenn., May 17-19

Chicago, Ill.—President Hurst is scheduled to deliver the opening address of the Southeastern conference on public works at Gatlinburg, Tennessee May 17, 1959. The three-day conference is under the general chairmanship of Murphy Snoderly, Consultant on Municipal Engineering, Municipal Technical Advisory Service, University of Tennessee, Knoxville. Convention headquarters will be the Riverside Hotel and technical sessions will be held in Gatlinburg's new convention center auditorium.

Mr. Snoderly

The Southeastern meeting is sponsored by Regions Three and Four of the APWA and therefore includes all Chapters in the area—Alabama, Georgia, Kentucky, New Orleans (Metropolitan), North Carolina, Tennessee, and Virginia-D.C.-Maryland—as well as the individual states not represented by chapters. Robert S. Hopson, Director of Public Works for Richmond, Virginia is Director of Region 3; Albert G. Wyler, Director of Streets, New Orleans, Louisiana is Director of Region 4.

An interesting technical program will be offered as well as entertainment and sightseeing befitting the scenic Tennessee Valley's Great Smokey Mountains National Park.

## Active Fall Program For Southern California Chapter

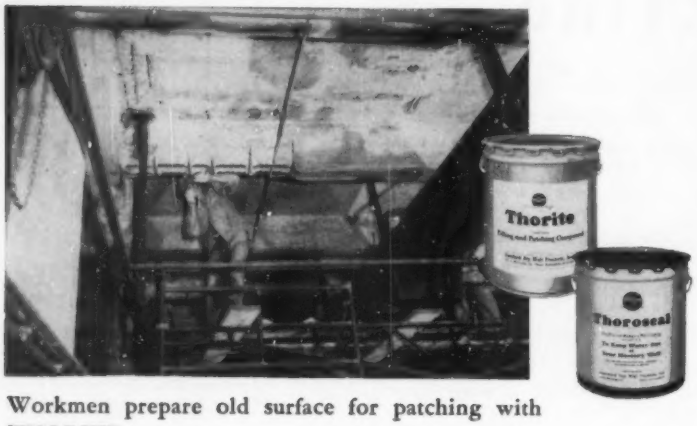
Los Angeles, Calif.—Spearheaded by the September "kickoff" message of President Frank Randall, setting forth "Today's Phenomena is Urban Expansion" the Southern California Chapter's fall programs were designed to explore the public works aspects of this problem.

At the September meeting "Hillside Subdivisions," an especially important subject in the Los Angeles area, was the topic of discourses by Clayton Paige, City Engineer, Burbank, and William A. Jensen, Assistant Superintendent of Building and Safety, Los Angeles County. Other papers included "Acquisition Under Assessment Acts" by Royal M. Sorenson, Attorney, Burke, Williams & Sorenson; "Problems in Right of Way Appraising and Negotiating" by Austin M. Hill, Director, Bureau of Right of Way and Land, Los Angeles; and "Practical Applications of The Assessment District Acts for Acquisition of Right of Way" by W. H. Krelle, Assistant Chief Deputy, County of Los Angeles.

At the October meeting Walter Hahn, Jr., City Administrative Officer of Inglewood, addressed the 140 members and guests in attendance on the subject "Planning—Today" while the December program was concentrated on "Money and its Availability for Streets and Highway Construction". Panel moderator at the latter session was Charles R.

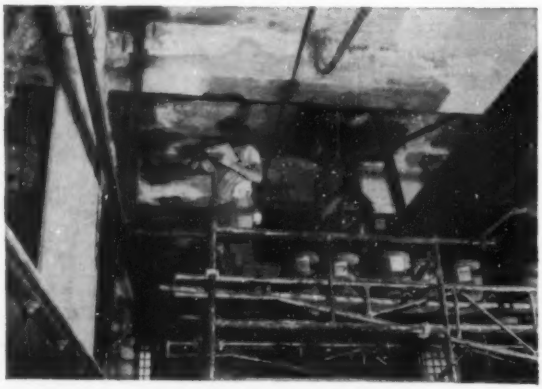
OFFICERS: Wm. D. Hurst, Winnipeg, Manitoba, Canada, *President;* Jean L. Vincenz, San Diego, Calif., *Vice President.* REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. *Immediate Past President,* Sol Ellenson, Newport News, Va. Robert D. Bugher, *Executive Director.*

# How THORITE and THOROSEAL made this underground structure sound again!




**Workmen prepare old surface for patching with THORITE.**

Water has entered the concrete and caused corrosion of reinforcing rods, blistering the concrete off surface and causing structural weakness throughout building.



Reinforcing was cleaned, all corrosion was removed and brush coat of THORITE applied over entire patching area, then filled in with trowel coats of THORITE, even with surrounding surfaces.

*THORITE Patching Mortar sets in 20 to 30 minutes and can be coated with THOROSEAL while hardening.*

*"How to do it"* GET OUR 16 PAGE BROCHURE

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNA. CENTERVILLE, IND.


Handy, Director of Public Works, Garden Grove. Panel participants included Edward T. Telford, Assistant State Highway Engineer, Division of Highways; A. S. Koch, County Surveyor and Road Commissioner, Orange County; L. A. Pardee, City Engineer, City of Los Angeles; and William C. Stookey, City Engineer, City of Fullerton.

## Chairman Named for 1959 ENR Aid-To-Education Award Committee

Chicago, Ill. — John Thompson, City Engineer, Madison, Wisconsin, has been named Chairman of the 1959 ENR Aid-to-Education Award Committee by President Hurst. August Zentgraf, Chief Engineer, Department of Public Works, Newark, New Jersey, is serving his second year as a member of the committee and the third and newly appointed member is W. L. Filby, Consulting Engineer, Black and Veatch, Kansas City, Missouri.

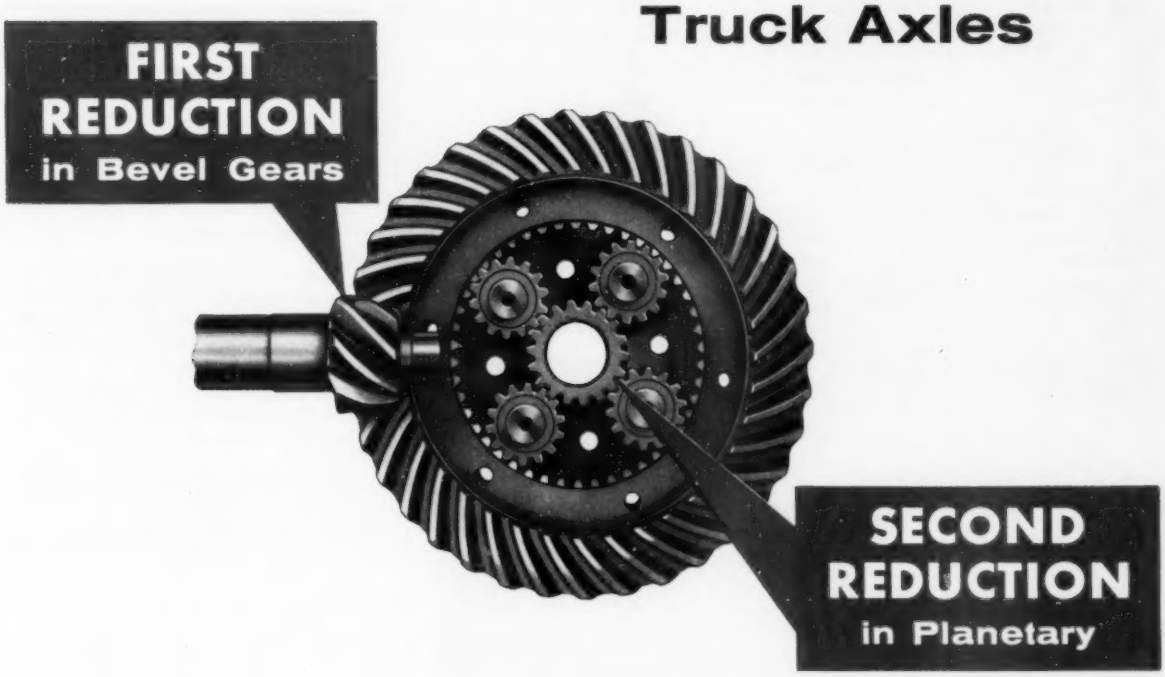
The Award, consisting of $1,000 for study in the field of public works engineering, is intended to provide financial assistance to deserving senior and graduate students of accredited engineering schools who wish to continue their education in preparation for careers in the public works field. To qualify for the Award, each candidate must have been employed on a full time basis by a municipal or similar public works agency for at least eight weeks, and must have satisfactorily completed three years of study at an accredited engineering school.

The winner also receives an all-expense-paid trip to the 1959 Public Works Congress in Seattle, Washington, September 20-23, 1959 at which time the Award is formally presented.

## Tennessee Public Works and Building Officials Committee

Nashville, Tenn.—The Tennessee Public Works and Building Officials Associations jointly sponsored an Institute at Nashville December 11-13, 1958. The Institute was conducted in cooperation with the Municipal Technical Advisory Service, The Bureau of Public Administration and the Tennessee Municipal League through the Division of University Extension of the University of Tennessee. Held at the Hermitage Hotel, the public works portion of the Institute featured lecture presentations and discussions on street lighting, sewage, refuse and water. The faculty consisted of E. E. Parks,

# A New Concept in Double Reduction Truck Axles




# Eaton Planetary Double Reduction

*Gives You these Important Benefits!*

**Save Weight**—Size for size, Eaton PDR Axles weigh less than conventional herringbone or spur gear axles, permit truckers to haul more legal payload.

**Last Longer**—In Eaton PDR Axles, gear tooth loads are equally distributed over four rugged "planet" gears; stress and wear are reduced, resulting in materially longer axle life. Eaton's forced-flow lubricating system provides positive lubrication to all moving parts, even at slowest vehicle speeds—a feature not available in other double reduction axles.

**Cost Less to Maintain**—When and if repairs are necessary, parts are readily available—most of them interchangeable with other Eaton Axles. Simple construction—similar to the famous Eaton 2-Speed Axle, with which all truck service men are familiar—holds maintenance labor to a minimum.

Previously, double-reduction axles have been available only in the extra heavy-duty sizes. Eaton PDR Axles are available in a wide range of sizes—the last word in equipment to meet the demands of today's hauling conditions. By actual comparison they cost less to buy, less to maintain. They have established outstanding performance records in all types of heavy-duty operation.

EATON

**EATON** AXLE DIVISION MANUFACTURING COMPANY
CLEVELAND, OHIO

Manager, Lighting and Heating Division, Nashville Electric Service; Robert L. Lawrence, Jr., Director, Nashville Water Department; Julian Fleming, Director, Division of Sanitary Engineering, and Mose W. Yates, both of the Tennessee Department of Public Health. Approximately 45 persons were in attendance. Robert D. Bugher, APWA Executive Director, was the guest speaker at the banquet, which also included remarks by Herbert Bingham, Executive Secretary of the Tennessee Municipal League and the presentation of certificates of attendance by Charles K. Marsh, City Manager of Kingsport, who is President of the Tennessee Public Works Association.

### Port Director Addresses New Orleans Chapter

New Orleans, La.—T. E. Ernst, Director of the Port of New Orleans, was the featured speaker at the December meeting of the New Orleans Chapter. With New Orleans' colorful history as background, Mr. Ernst recounted past construction and design of the Port as well as the improvement and expansion program now in progress.

*"Cuts maintenance to the bone"*

PACKAGED SIGNS
SPEED INSTALLATION

*To the natural advantage of light weight, Tassco provides these aluminum signs in pre-arranged packages ready for installation. The easy-to-handle panels are assembled on the job site and mounted in a matter of minutes.*

This is North Carolina's new Route 85, by-passing cities, moving traffic quickly with the help of a signing program by Tassco. The complete program consists of ground mounted and overhead signs. The signs themselves are increment sheet signs developed by Tassco especially for use on modern, high-speed roads. They can be had in any height or width and are designed to meet 100 mph wind loads. The use of increment sheets means new lows in the cost of both materials and installation. But what is most important, since the State has to bear the costs of maintenance, is that with 1193 signs, 501 sign supports, and with 9 large sign spans, not one drop of paint is required for maintenance.

North Carolina's signs feature the approved reflectorized green background with white AGA letters. However, reflective material or painted backgrounds are available in any type letters or symbols.

Helpful data, including a full color movie, is available from the Tassco-P & K Highway Planning Committee. Write for "Committee Data" today.

TASSCO

**TRAFFIC AND STREET SIGN COMPANY**
**84 FOUNDRY STREET, NEWARK, N.J.**


## NEWS OF ENGINEERS

ANDREW C. PATON has been admitted to partnership in Metcalf & Eddy, Engineers of Boston. Mr. Paton served with the Seabees in the SWP during the war, rejoining Metcalf & Eddy in 1951. He was field and later project manager for the Thule and other Greenland Air Force installations.

VERNON T. STACK has been appointed director of the new consulting division of Roy F. Weston, Inc., consultants in industrial water pollution control, sewage treatment, water supply and air pollution control. He will be located in the Newtown, Pa., office.

G. H. ABPLANALP, A. M. MOCK and S. H. SUTTON have become partners in Havens & Emerson, consulting engineers of Cleveland and New York.

HAROLD R. SHIPMAN has been appointed as chief of the Pan-American Sanitary Bureau Environmental Sanitation Branch. His headquarters will be in Washington and he will supervise sanitation in the western hemisphere.

G. GALE DIXON, widely known engineer, died Dec. 6. For the past 17 years he was chief sanitary engineer for Parsons, Brinckerhoff, Hall & McDonald; previously he was a member of the firm of Barbour & Dixon.

ARTHUR J. SCANLON of the New York City Department of Public Works died Dec. 26. He had been in charge of sewage treatment plant operation for New York. During the war he served in the Sanitary Corps, mainly in Africa, where he rendered unusual service.

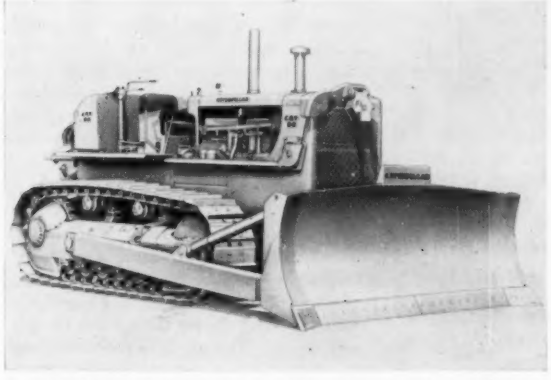
### 50th Anniversary for AWWA Section

On March 11 to 13, the Illinois Section, AWWA, will hold its fiftieth anniversary meeting at the Morrison Hotel in Chicago. The founding of the organization is said to have occurred with a conference of 37 water works men at the University of Illinois on February 16, 1909 and the consequent organization of the Illinois Water Supply Association. The Association became an AWWA section five years later. In tribute to this group, Governor William G. Stratton has proclaimed 1959 as a Water Works Year in Illinois.

# Caterpillar Introduces New D8, Series H Tractors

To move more dirt faster, and do it at lower cost, two completely new Caterpillar D8 tractors, both possessing increased weight, horsepower and productive ability, have been announced by Caterpillar Tractor Company. Known as the Series H models, they are available in both direct drive and torque converter drive.

An impressive list of improvements has been incorporated in the new models. Over 2 tons heavier, longer and higher than their predecessors, they feature flywheel horsepower increased to 225 hp with turbocharged engines. Among the many other changes made to increase performance and simplify maintenance are increased ground clearance (up 50% to nearly 20 ins.), lifetime lubricated rollers and idlers, dry type air cleaner, wider gage tracks that will accommodate 28-in. track shoes, and pressure lubrication of the entire power train with completely filtered engine-type oil. To facilitate operation, steering clutch and governor control levers are mounted on a console, steering clutches are hydraulically actuated and flywheel clutch

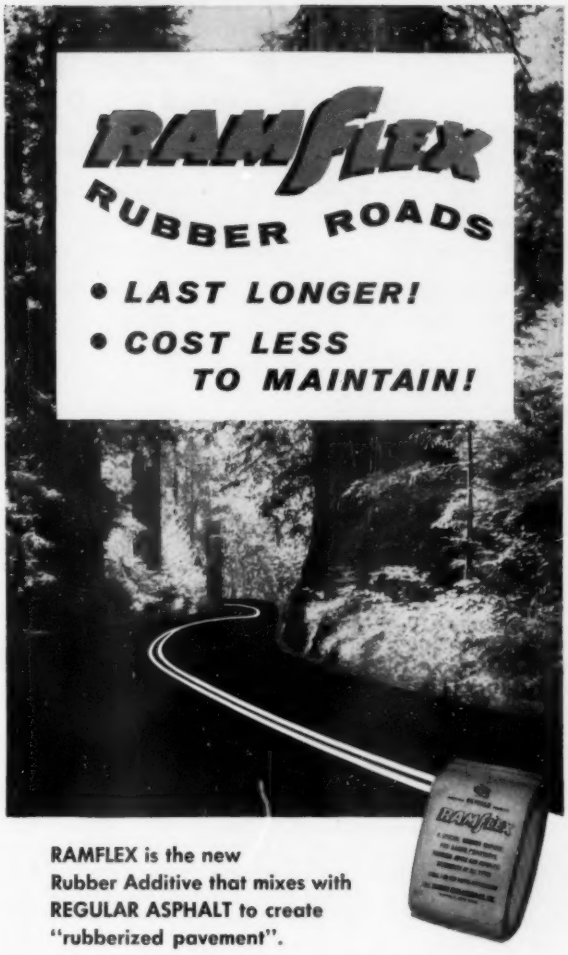


**● NEW D8, Series H Caterpillar Tractor with "U" type bulldozer designed to match the tractor's increased output.**

and brakes are hydraulically boosted. The new transmission on the direct drive model is directly reversing in all six speeds. Top reverse speed is nearly double that available on the previous direct drive model. In addition, the new high forward speed has been increased to 6.3 mph.

To match the new tractors' increased output, a complete new line of tools has been made available. These include straight, angle and "U" dozer blades, made larger than their predecessors and with the back of the blades fully enclosed; a new ripper incorporating a 5-position clevis and tooth; and larger sizes of hydraulic controls.

To get an idea of how much dirt the Series H D8 could handle, it was tested side-by-side with the D8 it replaces in the Caterpillar line. Both units were direct drive machines. The tests included dozing and drifting, with reverse travel. Operators were rotated to compensate for any differences in skill. Total overall production advantage for the newly developed D8 was 20 percent in all dozing operations tested, brought about by higher blade loads, greater speed under load and faster reverse speeds.


**RAMFLEX is the new Rubber Additive that mixes with REGULAR ASPHALT to create "rubberized pavement".**

RAMFLEX requires no special equipment and the paving mixture spreads rapidly, evenly and uniformly. The paving won't "shove" after placed, resists cracking in cold temperatures, and "bleeding" in hot weather. Stripping and raveling of road edges is reduced to a minimum. In addition, hot patches last far longer when made with RAMFLEX. This all means lower paving costs and practically NO maintenance.

All these advantages have been PROVED on successful state, county, city and private paving installations. Why don't you be the one to introduce the revolutionary new RAMFLEX Rubber Road to your local paving program. Regular contractors do the paving . . . we supply the RAMFLEX in convenient size bags. Write for the money saving facts, today.

*Send for this illustrated* No. 25
**FACT FOLDER**

Every paving contractor, every government official connected with paving programs should read this informative folder.

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P. O. BOX 365 BUFFALO 5, NEW YORK

PUBLIC WORKS DIGESTS

Prepared by

FRANK FORCE

Associate Editor

# THE HIGHWAY AND AIRPORT DIGEST

## Signing North Carolina Interstate Highways

North Carolina has elected to do the best job possible in erecting signs on the Interstate System and it is the intent of the state to comply with the requirements of the uniform Manual for signing the Interstate System 100 percent. It is the state's desire to erect the signs in a manner which will give the longest life and to have them fabricated from materials which will require the least maintenance. The majority of the sign structures used on the two finished Interstate jobs in North Carolina had clear spans of 90 ft. but two had spans of 94 ft. The structures are of aluminum of the square box truss type. A minimum of 15 cu. yds. of concrete per structure was used with some requiring 25 cu yds. The total time required for the erection of one of the structures was less than two hours. Regular sign erection crews and centerline striping personnel of the Highway Department were used for the entire job. Three separate crews were used in the sign erection. One crew of three men with a power auger digs the holes. A second crew of two men follows and places a wood box form over the top of the hole, suspends anchor bolts from the top of the form and makes the hole ready to receive concrete. Three men in the third crew fill the holes and forms with concrete from ready-mix-trucks. A light crane is used to hoist the sign in place.

"Signs for Interstate Highways." By Robert A. Burch, Traffic Engineer, North Carolina State Highway Commission. PUBLIC WORKS, January, 1959.

## Site Plans for Bridges

The site plan which is needed for the design and preparation of plans for any bridge should include complete topography, stream data, waterway determinations, subsurface exploration, availability of local material and special information. Complete topography should be surveyed and plotted and should cover an area having a length greater than the probable length of the proposed structure and a width extending beyond the toe of slope of the roadway fill. The data is normally plotted to a scale of 1 in. = 10 ft. on continuous roll cross section paper. Every effort should be made to determine accurately the elevation of maximum high water and other characteristics of the stream. Data from existing structures may be very useful in determining the waterway necessary in the proposed bridge. The area of the drainage basin above the crossing should be determined. Preliminary investigations should be made to determine the depth and suitability of the foundation material. If rock is not present, sounding rods or an auger may be used to explore the character of the foundation material. The availability and quantity of local material suitable for concrete aggregate, along with the location of quarries or deposits of stone suitable for rip rap or masonry should be noted. The nearest supply of lumber and the nearest railroad or shipping point are also useful information.

"Site Plans for Bridges." By J. N. Clary, Bridge Engineer, Virginia Dept. of Highways. PUBLIC WORKS, January, 1959.

## Travel Patterns in 50 Cities

During the past 15 years origin-and-destination traffic surveys of the home-interview type have been conducted in more than one hundred cities. This article presents data regarding the purpose for which trips were made by residents in 50 of these urban areas and the mode of travel they used. The percentage distribution of major trip purposes is fairly uniform in cities of all sizes. Analysis by mode of travel, however, shows a variable pattern. The proportion of trips by automobiles and taxis increases as city size decreases. On the whole, mass transit is by far the most prevalent mode of travel in the largest cities, but its relative importance varies depending upon the trip purpose. In most cases, the volume of daily trip by residents within an urban area is directly related to the numbers of persons, dwelling units and automobiles registered in the area. The relations vary, however, depending upon the trip purpose and mode of travel.

"Travel Patterns in 50 Cities." By F. B. Curran, Statistician, and J. T. Stegmaier, Highway Research Engineer, Bureau of Public Roads. *Public Roads*, December, 1958.

## City Adopts New Paving Technique

The City of Redlands, Calif., resurfaced many miles of old, very high-maintenance road-mixed pavements with a thin layer of an open-graded plant-mixed asphaltic surface. All work was done by a joint effort, with a contractor supplying a pavement finishing machine with an operator and a screed man, a distributor truck for the tack coat, and the open-graded mix delivered to the site. The city supplied a roller and any rakes needed. The pavement was first patched and thoroughly swept before surfacing started. A tack coat of R-1 emulsion was applied from 0.05 to 0.15 gal. per sq. yd. The surface material was then laid at a ½-in. layer and a 9-ton tandem roller was used for compaction. About 100,000 sq. ft. of pavement can be surfaced in an average day. This type of street surfacing costs between 2 and 2½¢ per sq. ft.

"Redlands, Calif., Adopts New Paving Technique." By Philip E. Johnson. *The American City*, December, 1958.

## Ready-Mixed Concrete Producers Eye Bigger Yardages

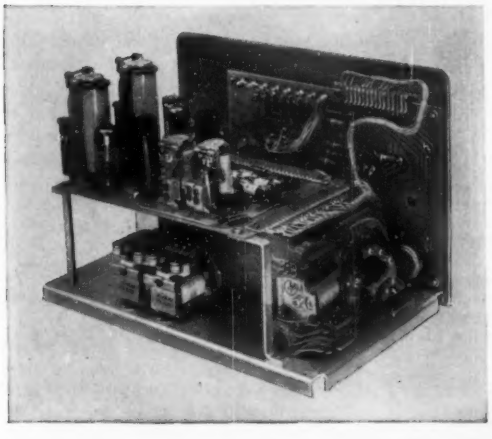
In respect to economy, there has been a new approach with portable batching plants which can be set up for the purpose of furnishing concrete for the road slab as well as the bridges and appurtenances. With this equipment, the ready-mix concrete operator can start to compete with the conventional paving methods in respect to cost. In ready-mix plants all the inspecting personnel and the management of the plant can examine and test all the con-

# NEW MODEL 507

## TRAFF-O-MATIC® CONTROL

### Provides Semi-Actuated Signal Control in its Most Advanced Form

**Model 507 combines the maximum of flexibility obtainable in semi-actuated control with many new design features. Emphasis is on reliability and accuracy of operation, simplicity and ready accessibility of all components.**



- **Advanced electronic circuit design employs unitized construction**
- **Printed circuit panels and line switch are jack connected**
- **Standard commercial high vacuum tubes are used**
- **Built-in directional detector relay permits direct connection to HRD Detectors**
- **A panel mounted "Detector Actuation" indicator light facilitates adjustment of timing dials**
- **New easy-open case is finished in textured green**

***For further details, write for Bulletin C-123***

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EASTERN INDUSTRIES, INC.
NORWALK, CONNECTICUT

# EXPANSION JOINTS ...

## used wherever good design requires a top-quality joint filler in concrete construction

The "SEALTIGHT" line of time and job proven, top-quality expansion joints are specifically designed to meet the needs of modern, properly-designed, properly-jointed concrete construction projects. Ideal for pavements, runways, bridges, buildings, ramps, etc. Produced to strict quality-control standards . . . available "from stock" at your local "SEALTIGHT" distributor for immediate delivery.

MEMBER
EXPANSION JOINT INSTITUTE

**ASPHALT EXPANSION JOINTS**
SEALTIGHT Premoulded Asphalt Expansion Joints have been in general use for more than 30 years. They provide initial low cost and durability. Entirely waterproof and rigid, they are highly recommended for most every joint installation. Furnished in cut sizes or slabs. Meets A.A.S.H.O. Spec. M-33-49 (also 42 and 48), A.S.T.M. Spec. D-994-53-T, U. S. Navy Dept. 4-Y-D and 13-Y-C, and all State and Federal Specifications.

**FIBRE EXPANSION JOINTS**
SEALTIGHT Fibre Expansion Joints are resilient and non-extruding, composed of durable cane fibre uniformly impregnated with asphalt. Furnished in cut sizes or slabs. Meets A.A.S.H.O. Spec. M-59-49, A.A.S.H.O. Spec. 153-52 Type 3, Federal Spec. HHF-334 and HHF-341a Type 1 Class B, A.S.T.M. Spec. D544-49 Type 5, U. S. Navy Spec. 4-Y-D paragraph 1-10 part 2, and all State and Federal Specifications.

**CORKFILL EXPANSION JOINTS**
Similar in general construction to Asphalt Joints, they are made up of a shockproof mass of clean, granulated cork particles, uniformly combined with pure blown asphalt. They are ideal where low water absorption, resiliency and non-extruding properties are desirable. Especially adaptable for residential and industrial floor slab areas in termite infested territories.

**SPONGE RUBBER EXPANSION JOINTS**
A fully resilient, non-extruding joint composed of high quality blown sponge rubber of uniform thickness and density. Gray in color to blend with concrete . . . used wherever exposed joints in concrete must be inconspicuous. Ideal for floors, wall panels, bridges, viaducts, etc.

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crete as well as the equipment that is manufacturing the concrete. The equipment needed for a portable central mixing plant of three cu. yd. capacity includes the following: A push bucket shovel of 1½-yd. capacity; belt conveyor to the aggregate bins; batchers underneath bins; belt conveyor to mixer; cement bin; cement and water batcher above mixer; three-cu. yd. mixer; power and controls; and from six to nine truck mixers or open body concrete trucks of 7-cu. yd. capacity (6.6 cu. yd.). There is a saving of time in delivery of the concrete to the road slab by using ready-mix concrete. Only one man is needed for batching at the central mix plant.

"Ready-Mixed Concrete Producers Eye Bigger Highway Yardages." By Glenway Maxon, Consulting Engineer, Milwaukee, Wisconsin. *Roads and Streets*, December, 1958.

### Design of Rigid Type Pavements for Cities

With the many underground utilities that prevail in every city, and particularly in Washington, D. C., there is need for frequent cutting into the pavement. This rules out the use of continuous reinforced or stressed concrete in city concrete pavement construction. Construction of long slabs is not practicable and in Washington 8-in. thick reinforced concrete slabs are constructed in 30-ft. lengths. It is of direct importance that provision for transfer of load be provided across all rigid pavement joints and this is accomplished by tie bars placed at regular intervals for longitudinal joints. The concrete of the pavement slab must develop sufficient strength, to support, under all conditions, the maximum traffic loads which may be imposed throughout its entire area. It is generally considered that strength of concrete is the controlling factor and that all other factors affecting quality will prove satisfactory if sufficient strength is developed. In general, specifications state that pavements may be open to traffic when the concrete has attained a specific strength of 550 psi. To reduce the loss of water through evaporation in curing of concrete, a wet burlap covering is used for 24 hours, which may be followed by continued wet curing or by the application of flake calcium chloride. The problem of winter concreting requires special attention whenever air temperatures may be below 50°F at the time of placing concrete. Concrete placed at temperatures of 100°F or over develops much lower

**INCHES $AVE THOUSAND$**
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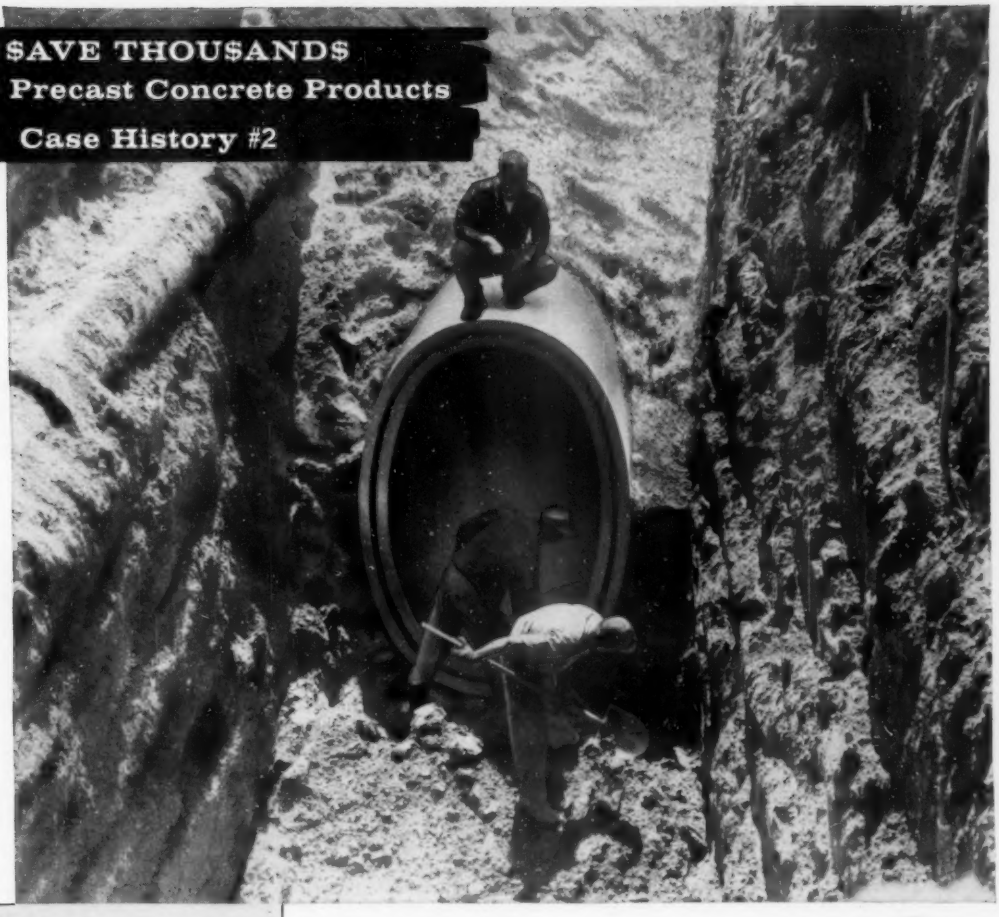
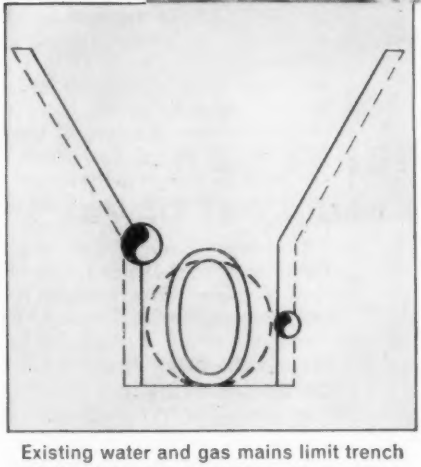
**Case History #2**





Existing water and gas mains limit trench width of Pontiac, Michigan storm sewer. HI-HED provides greater capacity within a workable area.

## A-M HI-HED® PIPE CUTS EXCAVATION COSTS DRASTICALLY!

- 18% narrower than equivalent round pipe, HI-HED Pipe cuts valuable inches from trench widths—can save contractors thousands of dollars in excavation costs.
- HI-HED saves customers the expense of removing or relocating utility lines.
- Another bonus benefit—HI-HED pipe design means higher velocities at low flow.

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strength; in fact, about the same as concrete placed at a temperature of 50°F or lower.

"Concrete Pavements for City Streets." By Harold F. Clemmer, Engineer of Materials and Research, District of Columbia. PUBLIC WORKS, January, 1959.

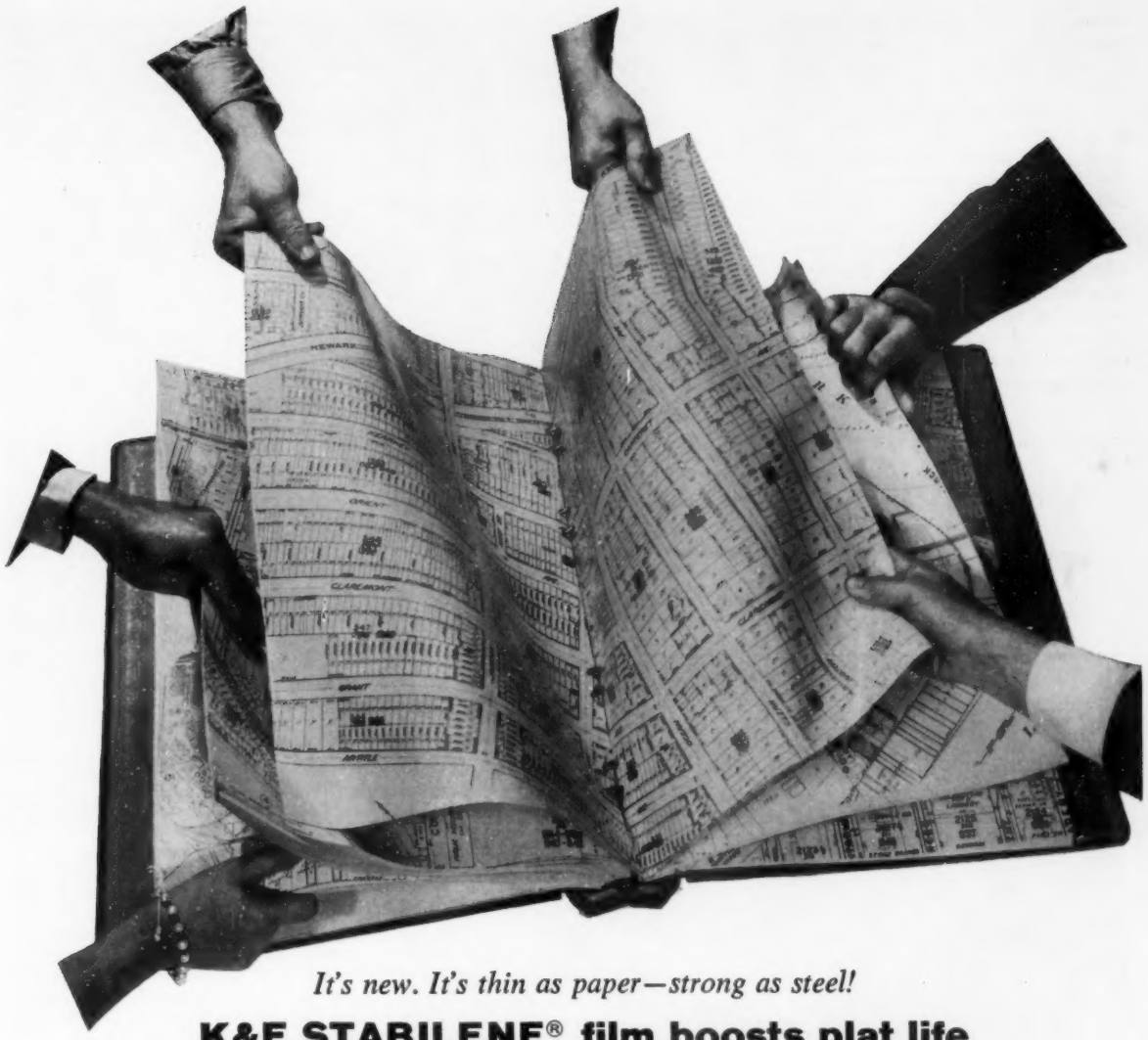
### Asphalt Pavements For Any Load

The versatility of asphalt paving poses special problems in design for the road-builder who must calculate his pavement requirements in terms of volume and type of traffic. The four principal things required to find the thickness of the individual layers and the proper total thickness of all layers are traffic analysis, materials analysis, alternate designs and economic analysis and selection of design. In the traffic analysis the following basis is recommended: Estimate the daily volume per lane of passenger cars and light trucks having single axle load of commercial trucks and buses expected on the planned pavement. Evaluation of all subgrade, improved subgrade, subbase and base materials should be made in the pavement design. Alternate designs may differ in type and thickness of the pavement surface and/or in type and thickness of the various elements of base, subbase and improved subgrade materials. In addition to initial construction costs, in the final selection of asphalt pavement design, consideration must be given to probable maintenance costs. Consideration also must be given to the level of performance expected of the facility, to the type of pavements under local climatic conditions, to the availability of funds and other such factors.

"Loading Design for Asphalt Pavements." By James C. Johnson, Staff Engineer, The Asphalt Institute. PUBLIC WORKS, January, 1959.

### Planned Lighting Pays Off for Small City

Brookings, S. D., is lighted completely and exclusively by fluorescent luminaires. In 1954, the first 34 fluorescent luminaires were installed. Today there are 1,148 luminaires in use; of this amount there are 1,073 two-lamp, four-foot units on the 34.5 miles of residential streets; and 75 four-lamp, six-foot units on the downtown business streets. For this vast amount of added light, power consumption has been increased five times from an installed capacity of approximately 50 kilowatts to 250 kilowatts. That



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means the city is getting 10 times as much lumen output and an average of about 50 times as much light for only about five times as much cost. Luminaires are installed eight to a block at heights of 30 ft. on steel poles in the downtown area. Residential units are spaced 150 to 180 ft. apart on one side of the street and mounted on 7-ft. brackets at heights of 25 ft. An underground wiring system is used in the business section, conventional overhead wiring in residential areas. Lamps are replaced on a scheduled basis to cut down the cost of servicing and to avoid unexpected outages.

"Planned Lighting Pays Off for Small City." By William H. Gamble. Electrical Commissioner, Brookings, S. D. *Street Engineering*, December, 1958.

### Other Articles

"Training Highway Department Personnel to Use **the Electronic Computer**." The Washington Highway Dept. has taken advantage of the electronic computer and has adopted an electronic section whose duties are to adapt highway problems to the electronic age. By W. A. Bugge, Director of Highways, Washington State Highway Commission. Public Works, January, 1959.

"Salt Stabilization: An Important **Road Building Tool**." Van Buren County, Mich., has stabilized 110 miles of roads with sodium chloride. By Paul J. Kaiser, Engineer-Manager, Van Buren County Road Commission, Paw Paw, Mich. Public Works, January, 1959.

"Importance of Soils Surveys and **Foundation Stabilization in Subdrainage**." Inadequate ground water control is recognized by engineers as one of the major causes of pavement failures. By H. Brian Wilson, Division Engineer, Corrugated Metal Pipe Association, Lansing, Mich. Public Works, January, 1959.

"Red River Valley Experiments with **Lime Stabilization**." Three projects in the Red River Valley of North Dakota and Minnesota used 4 percent lime to stabilize existing gumbo soil. By E. L. Lium, Dean, College of Engineering, University of North Dakota. Better Roads, November, 1958.

"**The Use of Yield Signs and Illuminated One-Way Signs** in San Diego." By Martin J. Bouman, Associate Traffic Engineer, San Diego, Calif. Traffic Engineering, December, 1958.

"**Computer Section Solves Earthwork Problems.**" This article moves, step by step, through the procedure used for solving earthwork quantities with the electronic computer in the Texas Highway Dept. Texas Highways, December, 1958.

"**Control and Protection of Traffic During Highway Construction.**" During road and highway construction, provision for adequate detours, barricades, directional and warning signs at or near a job site represents fulfillment of a public responsibility by contractors and Public Works departments as defined by law. Article covers the controls and devices used in highway construction. By Charles A Goodwin, Traffic and Transportation Engineer, Liberty Mutual Insurance Co. Public Works, January, 1959.

• • •

### Salaries of State Highway Engineers

Salaries of state highway engineers have risen an average of 16 percent in the last two years, the American Road Builders' Association reported in its fifth survey of State Highway Engineers Salaries. This is a comprehensive study of salary ranges for all grades of state highway engineers throughout the United States; and is a part of ARBA's active program aimed at improving the status of highway engineers through the establishment of salary ranges and benefits comparable to those offered engineers in private practice. Copies of the survey may be obtained by writing American Road Builders' Association, World Center Building, Washington 6, D. C.


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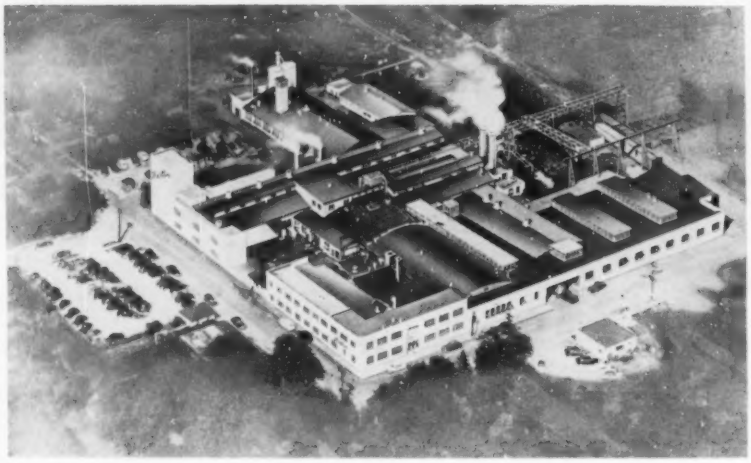

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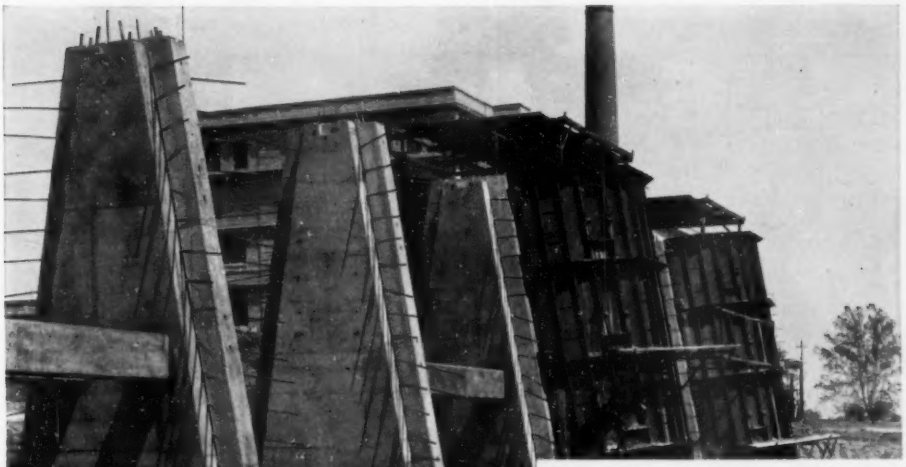

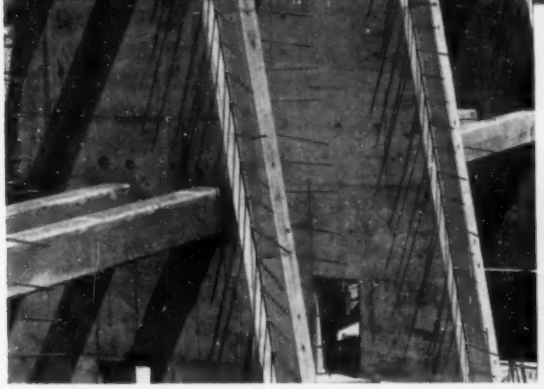

# LACLEDE STEELS reinforce unusual new water storage basin

Nine hundred and twenty-eight tons of Laclede multi-rib round reinforcing bars and other Laclede steel reinforcement are being used in a unique type of water storage basin now under construction at the Chain of Rocks Station, St. Louis City Water Department.

This will be an underground clearwater basin, where approx. 10,000,000 gals. of purified water will be stored before distribution to users in the St. Louis area. Unusual feature of the basin is the construction of its walls, formed by 60 huge cylindrical concrete shells, interconnected so that inspectors may examine the interior of the walls for the entire length.

Developed by E. E. Easterday, chief engineer for the St. Louis water department, this patented design provides a virtually foolproof barrier against contamination by ground water seepage.

Approximately 11,500 cubic yards of concrete will be used in the new basin.

General contractor on the project is G. L. Tarlton Contracting Co., St. Louis, and engineers are the Water Department, City of St. Louis.

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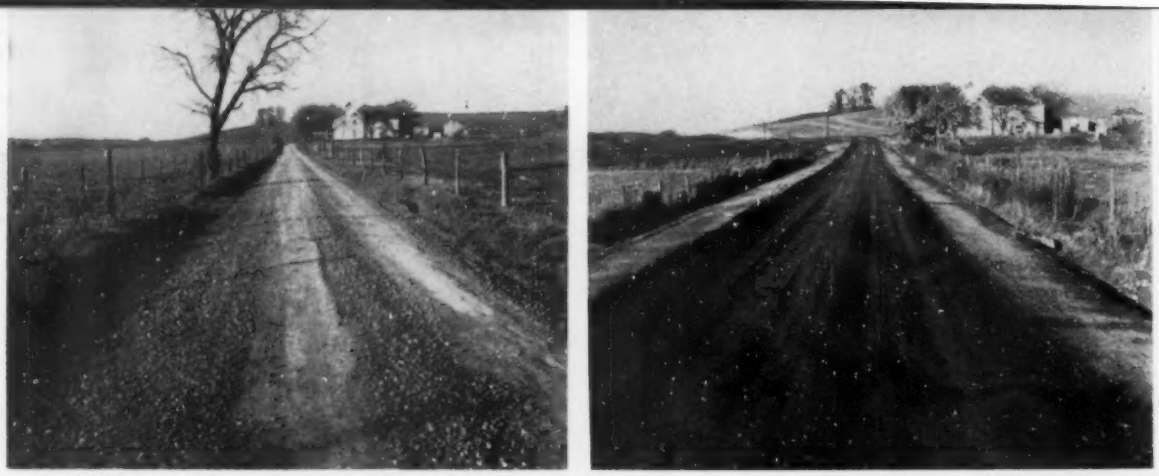


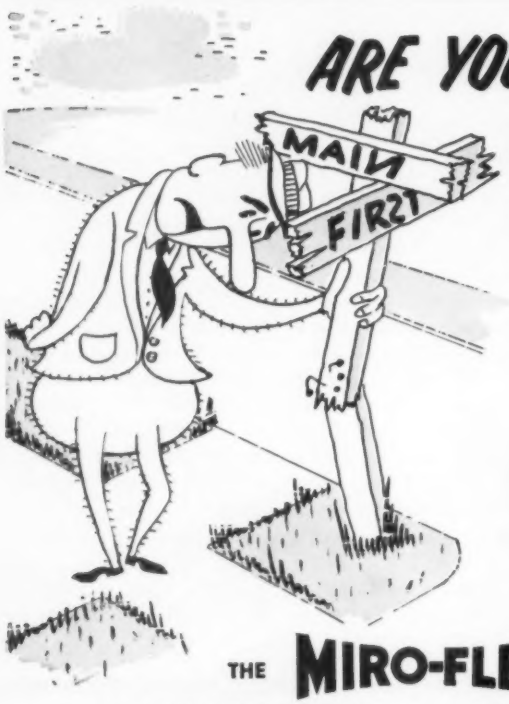
● SECONDARY road improvement is illustrated by these two pictures of surface conditions before and after treatment.

## PROGRAM FOR IMPROVEMENT OF SECONDARY ROADS IN THE VIRGINIA HIGHWAY SYSTEM

ALTHOUGH Virginia has about 20,000 miles of hard surfaced secondary roads, there are approximately 12,000 miles of nonhard surface roads serving from 25 to 100 vehicles per day. The Department of Highways has carefully judged the extent of expenditure for improvements against the value of service rendered by each road. Knowing that they cannot provide hard surface for all 12,000 miles, highway officials wish to provide comfortable roads without hard surface.

In conjunction with Federal Aid projects, the Department has scheduled improvement of several hundred miles of vital secondary roads annually, under the direction of J. V. Clarke, secondary roads engineer. Calcium chloride has been included to preserve the density and stability of the base while the mileage is carried over one or more winters. During this seasoning period any failures observed are corrected, before paving.

One of the chief purposes of calcium chloride is to achieve better and less costly maintenance. This maintenance is a part of providing a more comfortable and dustfree road until it is economically feasible to construct a higher-type surface. The curing period is of inestimable value in reducing the hazards of pavement failure when applied and in lightening the maintenance burden for the higher type surface.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# GARLON . . . *"mows" weed costs along guard rails, bridge abutments*

Mowing around guard rails is a mean job. Time consuming, costly and not very satisfactory. But there is an easy and inexpensive way to do the job—with vegetation control chemicals. Specifically, Garlon*—the newly created weed and grass killer from Dow research labs.

Garlon controls grass and weeds at a fraction of the cost of mowing. This combination chemical kills both broad-leaved weeds and grasses. And it can be sprayed at any time when weeds are young and growing, with sure results. Garlon is the fast-acting versatile herbicide that's easy to mix, easy to use. It's the ideal supplement to right-of-way mowing around guard rails, road signs, bridge abutments and all hard-to-reach areas.

Where brush is a roadside problem, Veon* 245 knocks it out. In fact, there's a specialized Dow formulation for every roadside vegetation problem—weeds, grasses or brush. And a planned *chemical* control program gives surer control at progressively lower costs each year. For additional information on use of chemicals in roadside maintenance write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Agricultural Chemical Sales Department 205 EC 2.

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*Prepared by*
**ALVIN R. JACOBSON, Ph.D**
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

PUBLIC WORKS DIGESTS

# THE WATER WORKS DIGEST

## Modern Water-Well Construction

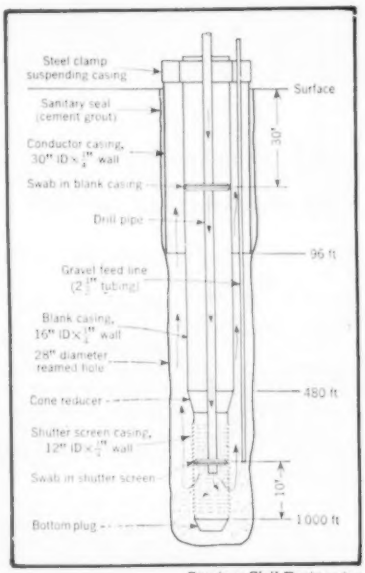
In recent years more and more emphasis has been placed on engineering procedures and specifications to insure satisfactory operation of well installations. The author has summarized these for high-capacity wells in California alluvial formations. A primary consideration in selecting the method of drilling for a given well is construction cost. Other factors being equal, the cable or percussion-tool method is more economical down to about 1,500 ft. This is particularly true with large-diameter bores where difficult drilling conditions are encountered. With wells to depths of 2,000 ft. and greater, where the formations encountered consist mainly of fine gravels, sands, and clay, the higher penetration rates achieved by the rotary machine tend to offset its higher operating cost. Many relatively inexpensive rotary wells are drilled, however, the costs sometimes being reduced through the installation of lightweight and less durable casings and by questionable construction practices. Such economies frequently result in considerably reduced well life. Four factors to be considered in designing a cable-tool-drilled water well are: 1) Hole alignment; 2) casing requirements; 3) perforation, and 4) development. The detailed discussion is accompanied by several pertinent diagrammatic sketches, photographs and tables.

"Modern Water-Well Construction in California." By Roscoe Moss, Jr. *Civil Engineering*, December, 1958.

## Backflow Preventers

The Joint Committee on Backflow Preventers was established in April, 1953, at the direction of the Board of Directors of AWWA and the Conference of State Sanitary Engineers (CSSE) to study backflow preventing equipment. Later the scope of the committee activity was expanded to include the whole field of cross connections and methods of control. This report provides an assembly of the pertinent information on backflow preventers and states certain findings concerning the use of this type of equipment. Its significant contribution is that it emphasizes the need for continued study and investigation and specifically designates seven areas for future exploration. It was also considered necessary to review briefly the recognized backflow prevention devices, methods and systems that have been most frequently used in cross-connection control in order to compare these older devices and methods with the newer reduced-pressure principle backflow prevention devices, which are the primary object of this report. General and specific conclusions and recommendations have been submitted at the end of this progress report. The report is printed in order to stimulate renewed interest in the subject and to solicit comment. It is worthy of study by everyone concerned.

"Use of Backflow Preventers for Cross-Connection Control." Joint Committee Report. *Jour. AWWA.*, December, 1958.




Courtesy Civil Engineering

● **DRILLING mud is used to keep a rotary drilled well open to install a gravel envelope in the outer annulus.**

## Why High-Rate Treatment?

Highland Park, Mich., recently dedicated its new 22-mgd high-rate water treatment plant to meet its booming industrial and residential water needs. At the heart of the system are two 11-mgd Graver Reactivators which provide for flocculation, sedimentation and sludge removal in a single, compartmental tank. They are up-flow, solids-contact units and operate on the principle of preformed floc. Raw water for Highland Park's system is drawn from Lake St. Clair, 11.6 miles away, by six centrifugal pumps. As the water enters the plant, coagulant is fed at the rate of 1.5 ppm of 8.3 percent $Al_2O_3$, and 1 ppm or less of activated carbon is used for taste and odor removal. Upon entering the Reactivator, the raw water with chemicals goes to the lower part of the central uptake where it is mixed with recirculated precipitate. From the uptake tube, the water enters the mixing and recirculation chamber where it is retained for 60 to 90 minutes to achieve intimate contact between the suspended precipitates and the impurities being removed from the water. Upon leaving the Reactivator, the water flows by gravity to the filters where it is filtered at approximately 3 gallons per square foot per minute. (See also PUBLIC WORKS for October, 1958).

"Why High-Rate Treatment? By Vernon L. Hinebrook. *Water Works Engineering*, December, 1958.

## Plastic Chlorination Systems

In seeking replacement materials for piping and piping components subject to corrosion in chlorination systems, the Los Angeles Department of Water and Power has turned to the use of plastic materials. Several factors were considered: 1) Effect of the chlorine on the material; 2) service under pressure; 3) adaptability to field fitting and future modification of the system; and 4) cost. In use at the present time are Kraloy PVC pipe and fittings and Chemtral PVC ball valves.

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## has ALL these features...

★ *Optional ground line break flange*
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*Before buying or specifying hydrants, be sure you know how these advantages may benefit your community.*

Optional break flange gives double protection against impact damage

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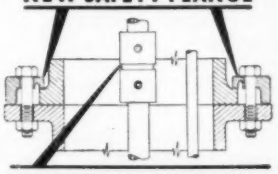

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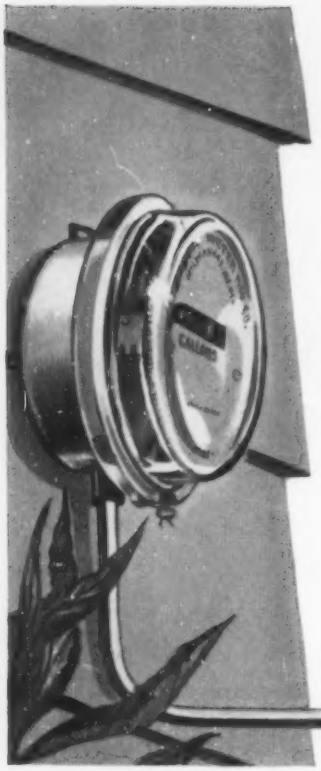

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*Pat. applied for in U. S. A. and foreign countries

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Kraloy plastic pipe and fittings are applicable because of their extreme ease of installation. The pipe is easily cut, fitted, heat formed, welded or threaded in the field with ordinary pipe cutters and threading tools. Barring physical abuse, the plastic piping and components are expected to have a virtually unlimited service life.

"Application of Plastics in Chlorination Systems." By Marvin H. Owen. PUBLIC WORKS, January, 1959.

### Plastic Pipe

Today the plastic industry has new piping materials that are available to the water works industry that offer: Economy; extreme corrosion resistance in handling aggressive waters as well as chemicals; freedom from electrolytic corrosion resulting in lower maintenance cost; and simple installation. Plastic pipe has been used for years by the gas and oil industries but has only recently been used to a limited extent by water works. However, there are available today semi-rigid plastic materials such as Kralastic, a styrene acrylonitrile material. It is produced in a variety of pressure rated schedules as well as in Schedule 40 and Schedule 80 iron pipe sizes. There is available Kralastic pipe of various pressure ratings ranging from 100 lbs. upward. It is recommended that pipe be selected that will allow for temporary surges of considerably higher than its pressure rating. For example, if the normal operating pressure is about 60 lbs. pressure, then 100-lb. pipe should be adequate to withstand the pressure. Available today are plastic piping which will do the job required and at the same time afford savings in construction costs.

"Plastic Pipe for Water Distribution." By H. M. McDaniel. *Water and Sewage Works*, December, 1958.

### Underground Corrosion

The annual cost to the U. S. pipe line industry alone, for protective measures and replacements due directly to corrosion, is estimated at $600 million. Researches by the National Bureau of Standards on the corrosion of underground structures, carried on for over 45 years, have been marked by steadily improved understanding of the casual factors at work and by the development of increasingly effective means of preventing the harmful effects that underground corrosion produces. An important phase of the work, now essentially complete, has been an extensive field-burial program to determine the specific behavior of metals and coating materials when exposed for periods up to 17 years in a wide range of soil environments. Data were obtained on nearly 37,000 specimens representing 330 varieties of materials. These were exposed for periods up to 17 years in 95 different types of soil at 128 test sites throughout the United States. At the same time, other phases of the corrosion program have led to increased information on the electrical and chemical aspects of the corrosion process, development of methods and instruments for measuring soil characteristics, improvements in the technique of cathodic protection, and virtual elimination of corrosion due to stray-current electrolysis. This is a summary of a technical report prepared by the National Bureau of Standards, U. S. Dept. of Commerce, Washington, D. C.

"Study of Causes and Effects of Underground Corrosion." By National Bureau of Standards, *Jour. AWWA*, December, 1958.

The same excellent report may also be found under the following:

"Underground Corrosion—Cause, Effect, Cure." *Water Works Engineering*. December, 1958; PUBLIC WORKS, December, 1958.

### Toronto Distribution

This article describes the water supply situation in 1953 when metropolitan Toronto was incorporated and gives a brief resume of the expansion program that has been carried out since that time, and also outlines the steps being taken to match the rapid pace of development. Toronto is a federation of thirteen municipalities, with an area of 153,000 acres and has a population of 1,416,000. In July, 1956, after 2½ years of concentrated design and construction, it was decided that the expansion program was not progressing rapidly enough to keep abreast of the accelerated development while catching up with the 15-16 year backlog of necessary facilities. An evaluation of the situation indicated that approximately 200 engineers (about 20 engineers were on the staff at that time), with an unlimited number of technicians and inspectors, would be required if the backlog was to be eliminated before 1960. The plan finally adopted to expedite completion of outstanding projects provided for the engagement of consulting engineers on every line of endeavor. After 4½ years, Operation Backlog is nearing completion. The capacity of water treatment plants has been increased from an original reliable capacity of 235 mgd to 355 mgd. Major extensions have been completed at the R. C. Harris and Scarborough plants. Contracts for rehabilitation of the Island Filtration Plant have been awarded and the work almost completed. Electrical conversion from 25 to 60 cycles has also been completed for the most part. To date, 299,150 ft. of new water mains, ranging in size from 24-in. to 48-in. have been laid. The total expenditure for the period was $41,544,000. Plans have been completed for further expansion through to 1980, when the population will be about 2,100,000.

"Progress in the Toronto Distribution System." Ross L. Clark. *Jour. AWWA.*, December, 1958.

### Other Articles

**"Pressure Pipe** in Public Water and Sewerage Utilities." This study by the Water and Sewerage Industry and Utilities Division of the Business and Defense Services. Administration presents estimates in millions of feet of pressure pipe presently installed and in use in the Nation's public water and sewerage utilities and projected estimates for the year 1975. By Walter L. Picton. Public Works, January, 1959.

"Philadelphia Goes **Push Button.**" New intelligence center will control loading in pumping stations, filters, reservoirs, fire systems and distribution lines, for economy and efficiency. By Samuel S. Baxter. Water Works Engineering, December, 1958.

**"Cross-Connections** are Dangerous." The hazard of cross-connections was vividly shown at Shreveport, La., when such a connection, created by a private automatic lawn sprinkling system, caused an epidemic of 72 cases of enteritis. By Floyd M. Miller and Ben Freedman, M.D. Water Works Engineering, December, 1958.

**"Polyphosphate Treatment."** The article provides the reader with a broader insight and a better understanding of the qualities and applications for the hexametaphosphates. By Davis E. Speeg. Water and Sewage Works, December, 1958.

"Sizing **Water Service Piping.**" The author sets forth rather complete details on the recently revised specifications of the Milwaukee Water Works for water service piping. By Arthur Rynders. Water and Sewage Works, December, 1958.

"Integrated **Water Resources Use** and Development." In this excellent and timely article, the author wishes to provoke a critical view of the water problem and a consideration of some new approaches which appear to hold good prospects of meeting the pressing water needs of the future. By C. J. Velz. A.J.P.H., December, 1958.


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# WATER TANK CONFORMS TO AIRFIELD STRUCTURE

**CHARLES MOORE,**

**Pacific Air Force Base Command**

AT HICKAM Air Force Base, Hawaii, a sprawling community of homes, schools, shops and churches, special care was taken to keep the water tank in conformity with other structures on the base. In doing so Hickam not only retained the tank's intended usefulness, but also added to it.

When the air base was being constructed in 1937, the engineer, a young Quartermaster Corps captain, decided to enclose the tank with a thick shell of reinforced concrete. Since the air surrounding the Hawaiian Islands has a high concentration of salt, metal deteriorates rapidly. As the captain foresaw, the concrete shell has protected the steel water tank for more than twenty years, saving the government considerable maintenance costs and many manhours of work a year.

However, the real test came on the morning of December 7, 1941. At 7:55 AM, Japanese planes roared out of the cloud bank that shrouded the Koolau Range and opened an attack that left many dead and wounded in the tangled wreckage that once was barracks, hangars and maintenance shops.

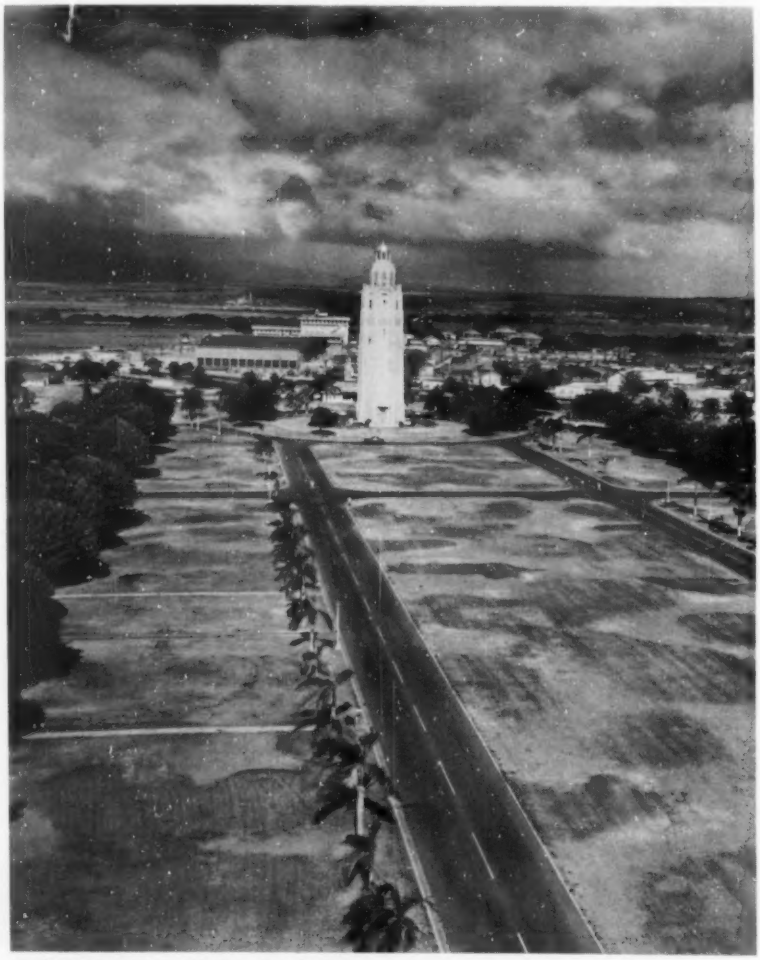
Because of its physical appearance, the water tower was a prime target for the Japanese fighter pilots. Three ten-minute attacks, each more furious than the last, were sustained by the base. Through this onslaught the thick concrete shell protected the metal water tank and probably saved Hickam's primary water supply.

An important defense factor not directly related to the tank's protection, is the tower's suitability as a Ground Observer Corps lookout post. Atop the Hickam tower is a room that was used effectively as a radio transmitter station in World War II. A spiral staircase winding from the base makes the room easily accessible.

Still another important factor, and one which will interest many community leaders, is the tower's aesthetic value. After its completion the tower was regarded as one of the most beautiful man-made structures on the Island of Oahu. Today, more than twenty years after its construction, it stands as a mirror of beauty; a majestic structure at the end of a long green mall. Each Easter Sunday the tower serves as an inspirational backdrop for the Protestant Sunrise Services. At Easter and during the Christmas season, an electrically-lighted Christian cross hangs from the front side of the tower. It is visible for miles.

Completed in January 1938, the metal tank was constructed by the Chicago Bridge and Iron Company. The E. E. Black Construction Company of Honolulu built the concrete shell. The tower stands 171 feet high, is octagonal in shape, measures 14 ft. 6 ins. to a side and has a radius of 18 ft. 5 ins. The walls are of reinforced concrete, 12 inches at the base, with a gradual reduction to eight inches at the top. The width at the base is 34 ft. 10 ins. Near the top are 8 beautiful precast eagles, weighing one ton each. The surge or stabilizer tank inside is cylindrical with a capacity of 530,000 gallons.

Every "malihini" (newcomer) and many a "kamaaina" (oldtimer) to the Islands ask, "What is that beautiful tower?" A look of surprise crosses their faces when told that it is only a water tank, built by a community that takes pride in its appearance.

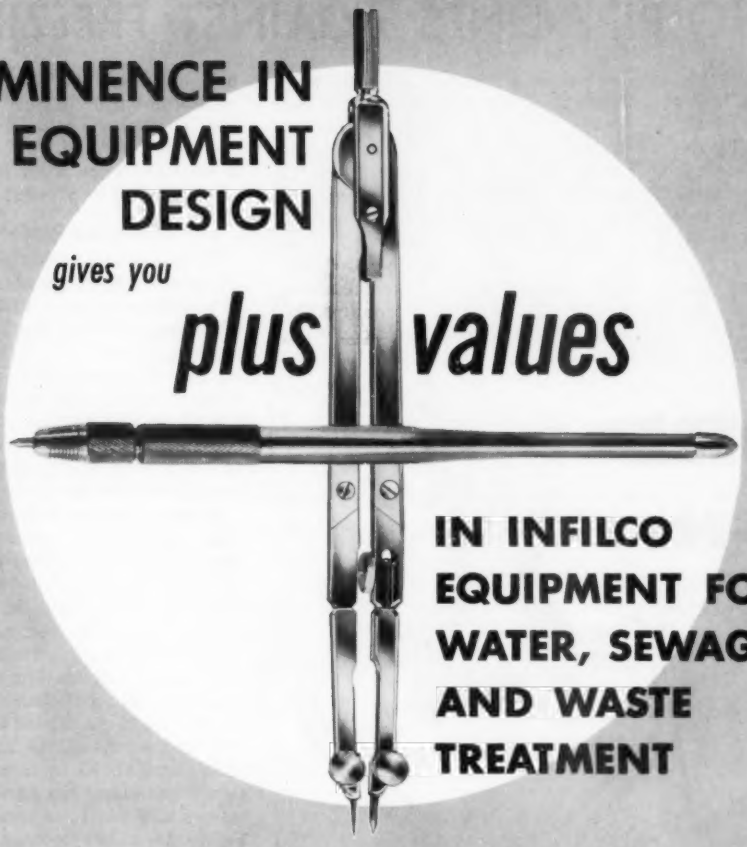


● **WATER tank at Hickam Field is of steel and is protected by a reinforced concrete shell against the salty sea air. Pearl Harbor Naval Base is visible in background.**

# EMINENCE IN EQUIPMENT DESIGN

*gives you*

# *plus values*



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*Two Methods Used in Chicago for*

# PROTECTING PIPE LINES AGAINST FREEZING

A 42-IN. CAST IRON mechanical joint pipe 273 feet in length was completed in 1957 across the North Branch of the Chicago River by the Chicago Department of Water & Sewers. A new bridge was necessary because the existing bridge was not suitable to carry the 42-in. water pipe.

The bridge was designed and constructed by the Department of Public Works. It consists of a structural steel deck bridge of 143-foot span at the same elevation as the existing bridge. The 42-in. pipe was installed by the forces of the Water Distribution Division. Of the 273 feet of pipe laid, 183 ft. was frost protected with an insulating blanket consisting of three layers of one-inch fibre glass. Over each one-inch fibre glass covering, a layer of tarred felt was applied. For weather proofing the fibre glass and tarred felt covering, a light weight corrugated covering of aluminum 0.006 inch in thickness was applied over the final layer of tarred felt. At each end of the bridge a cyclone fence with barbed wire was installed to prevent trespassing.

### *Electrical Protection*

In connection with the Prudential Plaza area development in Chicago, it was necessary to install 1255 ft. of 24-in. and 18-in. steel pipe, Dresser coupled. Of this, 1243 ft. had to be placed above ground or otherwise exposed and all of this was electrically heated and insulated to prevent freezing. Much of the pipe, which had a wall thickness of ½ inch, is suspended under sidewalks.

It was necessary to anchor the pipe securely to prevent sliding caused by vibration induced in the structure by traffic. It was also necessary to insulate the pipe electrically from the steel structure to protect the pipe from stray electrical currents originating in the electrified railroad below and from electric conduits. This was done by inserting a rubberized asbestos material, called Kearsarge gasketing tape, between the steel anchor clamps and the steel pipe. The gasketing tape has a high dielectric strength as well as a high coefficient of friction. To provide electrical insulation between the steel viaduct structure and the thrust anchors at tees and dead-ends, a cloth-base bakelite sheet of high dielectric strength was used.

Because the entire pipeline is exposed to freezing temperatures, an automatic electrical heating system was installed and the pipe and electric heating cables in turn were covered with asbestos insulation. Heat is supplied to the pipe from General Electric lead-sheathed heating cables, strung parallel to and on the surface of the pipe and spaced at approximately 6 ins. on centers around the circumference. There are fourteen cables on the 24 in. pipe and ten on the 18 in. pipe. The cables are threaded through drilled holes in the Dresser coupling followers.

Inasmuch as the pipe requires one lineal foot of cable for one square foot of surface at —20°F., there is an approximate 2 to 1 safety factor of heating cable as installed. The cable requires 2 volts per lineal foot and the system is designed for nominal 240-foot lengths, making individual


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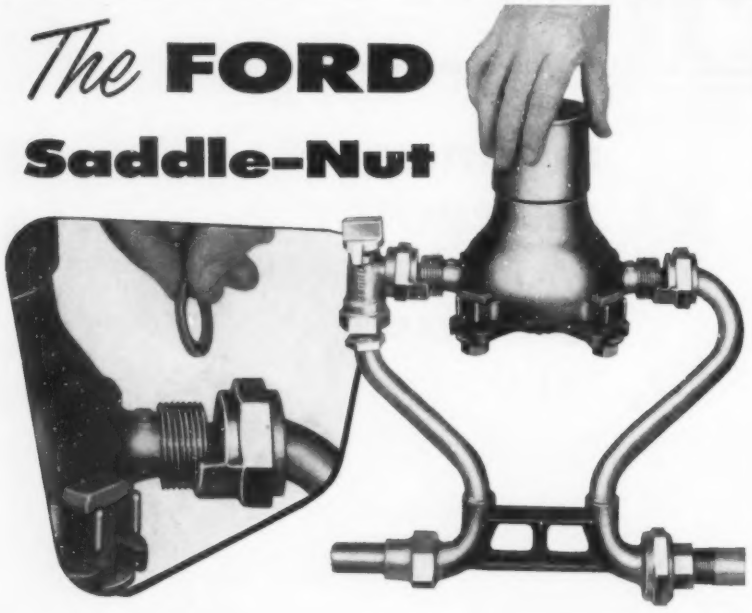
**Saddle-Nut**



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circuit loops 120 feet long, requiring 480 volts. The electrical power can be supplied through either one or both of two 208-480 volt transformers. Two separate parallel electric feeders supply alternate circuits of heating cables about the circumference as an additional safety measure. Thus a failure of one of the electric feeders will leave one-half of the electrical heating system in operation, which is sufficient protection at a temperature of —20°F.

The heating system is divided into six sections. Each section has two separate electric feeders each of which is controlled by a separate thermostat. If, for any reason, either half of any section is demanding heat and there is a failure to energize the section, such failure will be indicated on alarm panels. Also, if for any reason the temperature of the water in the pipeline should become dangerously low, an alarm horn will sound. Temperature recorders are installed at each of two alarm panels which record the water temperature at four different locations along the pipeline. The heating system is rated at 100 kilowatts capacity.

Thermal insulation consisting of asbestos sponge felt, pre-molded with 40 laminations per inch of thickness and in 3-foot lengths shaped to fit the pipe, was installed over the heating wires. The pre-molded insulation is secured to the pipe with ¾ in. by 0.020 in. stainless steel straps located exactly over the gasketing tape supports. This in turn is covered with a weatherproof jacket of 50-pound asphalt saturated and coated asbestos felt, with sealed joints. The jacket is secured with ¾ in. by 0.020-in. stainless steel straps on 6 in. centers.

The sponge felt is supported on ½-in. thick Kearsarge gasketing tape which creates a ½ in. air space between the outer surface of the pipe and the inner surface of the sponge felt. The gasketing tape is 2 ins. wide and wound around the circumference of the pipe at 18 in. centers. These tapes are notched on the inner surface to form a support for and properly space the electric heating cables. The ½ in. dead air space provides added insulation as well as an allowance for freedom of movement that prevents the breaking of the heating cables as they expand and contract. All heating cables were tested before and after the thermal insulation was installed.

These data are from the 1957 report of the Chicago, Ill., Department of Water & Sewers.

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All users notice the difference. Jaeger's slower running speed (only 1700 rpm @ full load) consumes less fuel; better control holds pressure constant; air is 100° cooler than with old-type compressors; the machine is smoother, quieter, simple to operate, easy to move. Ask your Jaeger distributor to show you, or send for Catalog JCR8.

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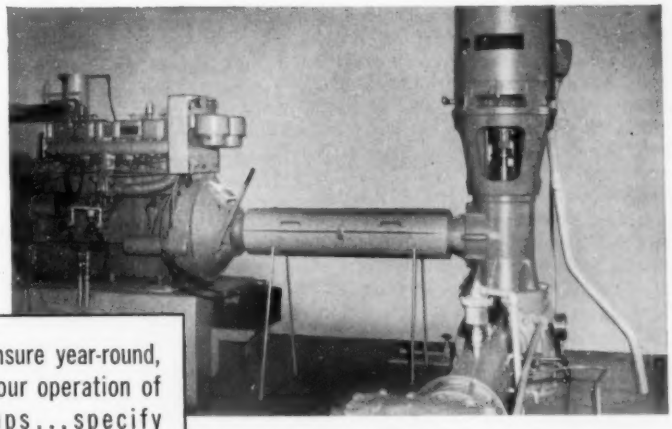

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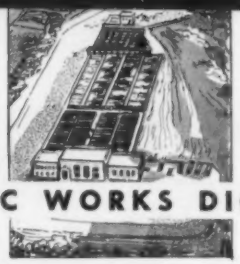


PUBLIC WORKS DIGESTS

*Prepared by*
**ALVIN R. JACOBSON, Ph.D.**
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

# THE SEWERAGE AND REFUSE DIGEST

### Frankfort Says "Keep It Clean"

Forty-two miles of new sewers, eight lift stations and a primary sewage treatment plant go a long way toward the Frankfort, Kentucky, goal of keeping the Kentucky River clean. The outfall and treatment facilities are capable of serving a population of about 39,000 persons. The city's present population is approximately 29,000, including some 8,000 persons recently annexed. Interceptors with storm overflow devices now carry the dry weather flow to the treatment plant, while heavy storm flows still discharge directly into the river. Eight lift stations now pump the sewage from the high bluff areas to lines connected with trunk sewers leading to the treatment plant. The treatment plant as constructed can handle adequately a daily flow of 3,400,000 gallons. Sewage is first metered through a Simplex parabolic flume and then pumped to the grit chamber and comminutor. The sewage then flows to two Walker clarifiers. Primary sludge and scum are pumped to a Dorr Thickener and then to the digesters. The two digesters are provided with floating covers, heat exchangers and gas recirculation systems; and sludge recirculation pumps. Fourteen beds are available for sludge drying. Financing is provided by connection and service charges. The new connection charge is $300, payable at $2.50 per month over a period of 10 years. The sewer service charge amounts to 150% of the water bill.

"Frankfort, Ky., Says "Keep It Clean." By Dr. William Moore. *The American City*, December, 1958.

### Role of Fungi in Sewage Treatment

Mold spores are prevalent in the atmosphere and may settle out of the air into water or onto the soil and eventually get into sewage or industrial wastes. Very little, however, is known concerning the role they play in waste treatment, and the public health or other harmful effects, if any, that may result from their presence in contaminated water. The Robert A. Taft Sanitary Engineering Center has been engaged in research to provide the basic information necessary for evaluation of the significance of fungi in water, and to develop methods for their intelligent use in waste treatment. This article relates that the wide variety of mold fungi all about us have a wide variety of habitat and nutrient requirements, most of which may be met by the materials present in sewage. Molds are scavengers, and what better place for scavengers than a sewage treatment plant where a wide variety of foods are available?

"Are Fungi Important in Sewage Treatment?" By Wm. B Cooke. PUBLIC WORKS, January, 1959.

### Aerobic Biologic Treatment

For about 25 years prior to 1940 there were no methods or facilities available for sewage treatment that filled the void between the conventional primary and secondary treatment methods. However, since 1940 a significant new concept has been introduced which held that biological treatment could be adapted to give any degree of treatment desired. The development of the high-rate filter with recirculation gave impetus to this concept. Almost all recent developments in activated sludge treatment are aimed at increasing oxygenation rates in order to permit high solids concentrations (more floc) in a given tank volume.

## CATCH BASIN CLEANER SAVES MANHOURS

USING two machines, the City of Evanston, Illinois, cleaned 3,958 catch basins during eleven months of 1958. The manhour requirement for this work, excluding that for transportation, was 2,696, which represents a cost of about $1.70 per basin. The machine employed uses a 1-cu. ft. clam-shell bucket which may be lowered into 18-in. diameter openings. It is operated by a hoist powered by a 3-hp gasoline motor. The whole assembly is skid-mounted on a 2-ft. 3-in. by 7-ft. frame attachable to a standard dump body. Thus the clam shell dumps in the same truck used for transportation of the unit. The cleaner, a type which has been used by Evanston for over 16 years, has recently been placed on the market, being sold by the Catch Basin Cleaner Mfg. Co.

# P. F. T. Gas Scrubber Saves Miami Plant

## $25,000 A Year

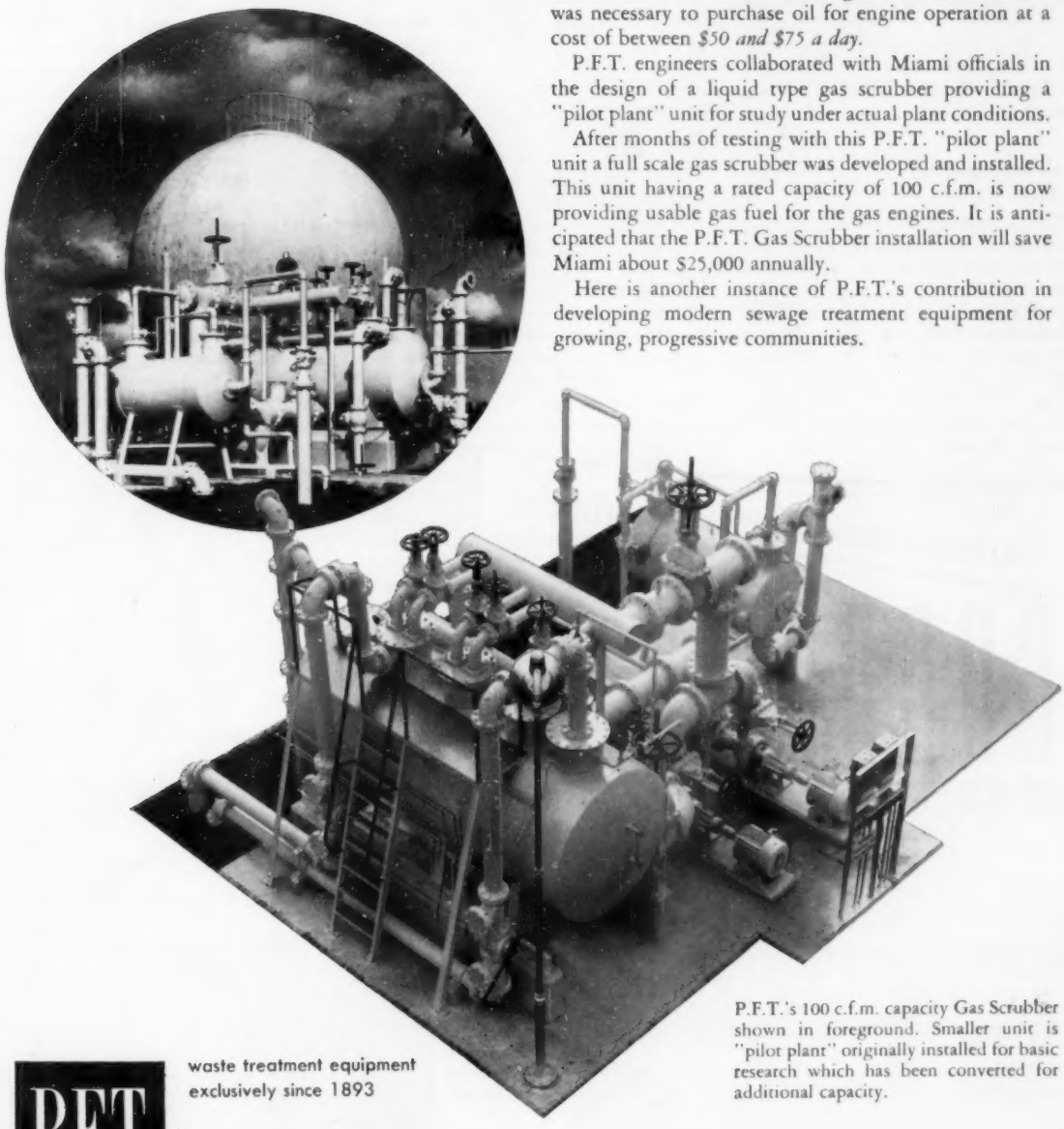
The formation of hydrogen sulfide has been the source of operating and maintenance problems in sewage treatment plants in many sections of our country—Miami, Florida's new plant was no exception.

Normally, sewage treatment plants produce and collect their own gas for fuel use. At Miami the gas was found to have a very high hydrogen sulfide content—so high that it could not be used for engine fuel. Therefore, it was necessary to purchase oil for engine operation at a cost of between *$50 and $75 a day.*

P.F.T. engineers collaborated with Miami officials in the design of a liquid type gas scrubber providing a "pilot plant" unit for study under actual plant conditions.

After months of testing with this P.F.T. "pilot plant" unit a full scale gas scrubber was developed and installed. This unit having a rated capacity of 100 c.f.m. is now providing usable gas fuel for the gas engines. It is anticipated that the P.F.T. Gas Scrubber installation will save Miami about $25,000 annually.

Here is another instance of P.F.T.'s contribution in developing modern sewage treatment equipment for growing, progressive communities.



P.F.T.'s 100 c.f.m. capacity Gas Scrubber shown in foreground. Smaller unit is "pilot plant" originally installed for basic research which has been converted for additional capacity.

P.F.T.

waste treatment equipment exclusively since 1893

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"Tapered aeration" and "Step aeration" were two of the modifications developed to meet the high oxygen requirements. Equipment manufacturers have developed many new and ingenious devices for diffusing air into the mixed liquor and these are briefly described in this article. In addition, modifications in the conventional activated sludge process are being made to suit particular needs, such as: 1) a lesser degree of treatment; 2) a small package-type plant; or 3) economy in plant construction operation cost. The author discusses a few of the more significant of these modifications.

"Recent Developments in the Aerobic Biologic Treatment of Wastes." By Daniel A. Okun, PUBLIC WORKS, January, 1959.

### Turbine Aeration of Streams

This paper reports on a study of aeration of stream flow at power turbines as a part of the cooperative state-industry stream studies in Wisconsin undertaken by the Wisconsin Committee on Water Pollution and the Sulphite Pulp Manufacturers Research League. The following general and specific statements are made in the nature of conclusions drawn from the results obtained: 1) The admission of air to a turbine for the purpose of introducing oxygen into the water presented no serious installation or operational difficulties. 2) The amount of oxygen absorbed by the water seemed principally dependent on the DO saturation level of the water, and on the amount of air admitted. 3) An increase of 0.16 to 1.57 ppm DO, or a gross gain of 525 to 9,471 lb. of oxygen per day per 1,000 cfs, was obtained depending on test conditions. 4) The waters passing through a turbine, when air was not being admitted, sometimes lost a portion of the dissolved oxygen. 5) The data indicated that, when stream waters passing through the turbine contain wastes in an advanced stage of decomposition, a slight decrease in BOD is obtained. 6) Stream aeration by means of turbine venting was superior to aeration by compressor and air diffusion through tubes and plates. As is usual with a new project, much remains to be learned. It is hoped that there will be enough interest taken by others to obtain more test data on the procedure in the near future.

"Aeration of Stream Flow at Power Turbines." By R. H. Scott and T. F. Wisniewski; and B. F. Lueck and A. J. Wiley. *Sewage & Industrial Wastes*, December, 1958.

### Salmonella in Digestion

Anaerobic digestion has been used for many years to stabilize sewage sludges. Digester retention times have been shortened to less than one month by a) heating the sludge mass to an optimum temperature for bacterial metabolism; (b) recirculating the digester contents; and c) using two-stage digestion. Recently, the concept of high-rate digestion has been introduced. The economic advantages to be gained through the use of high-rate sludge digestion are obvious. At the same time the advent of high-rate digestion has caused concern over the possible increased survival of pathogenic bacteria during the process due to the short retention periods. The purpose of this paper is to present an analytical method for the quantitative enumeration of *Salmonella typhosa* and related enteric bacteria and to show their degree of survival during high-rate anaerobic sludge digestion. In summary the results show: 1) The spot plate technique with selective media can be used for the quantitative enumera-


the process...
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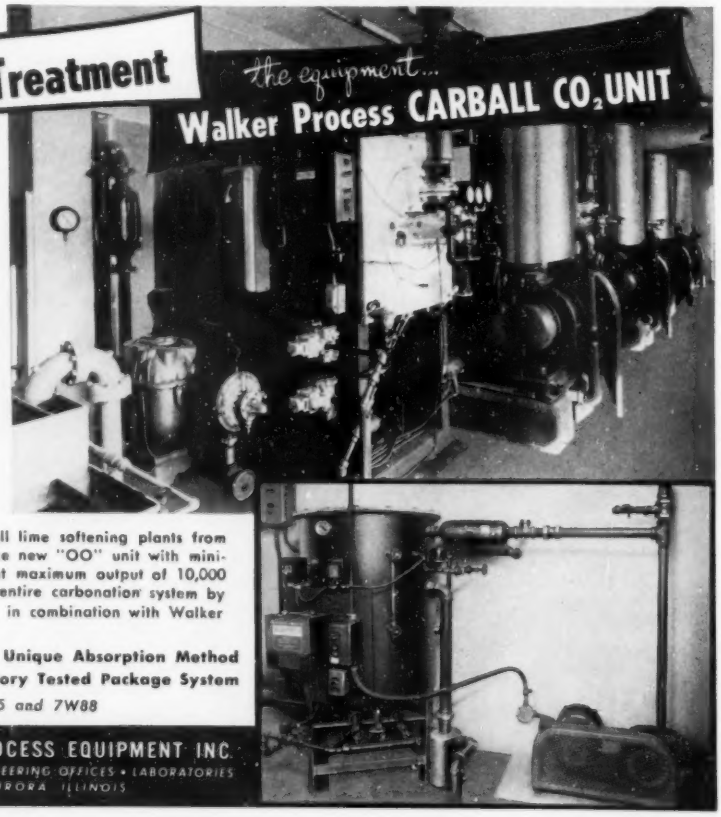
CARBALL
$CO_2$ UNIT



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Walker Process now offers carbonation units for all lime softening plants from the very small to the largest. Sizes range from the new "OO" unit with minimum capacity of 55 lbs. $CO_2$/day to the No. 4 at maximum output of 10,000 lbs. $CO_2$/day. Engineers can readily provide an entire carbonation system by simply specifying the appropriate size CARBALL in combination with Walker Process SPARJER diffusers . . . . . assuring

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- √ WHIP ACID ATTACK

Coupling TYLOX-Gasketed pipe is as fast as the few seconds required to shove pipe home into the line. Mud and water, as shown here does not slow up the work, or affect the compression seal.

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**TYLOX Gaskets** are made of rubber specially compounded for immunity to sewage and industrial waste acids and alkalies. Under ground and under compression, they outlast the life of the pipe itself.

***SEND FOR ENGINEERING DATA AND ILLUSTRATED CASE HISTORIES ON TYLOX RUBBER PIPE GASKETS***

* **PROJECT:** City of Buena Vista, Va., trunk line to sewage treatment plant.

**ENGINEERS:** R. Stuart Royer & Associates, Richmond, Va.

**CONTRACTOR:** English Construction Co., Alta Vista, Va.

**PIPE:** TYLOX-coupled T & G in 15" to 24" diameters, manufactured by Roanoke Concrete Products Co., Inc., Roanoke, Va.

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tion of certain enteric bacteria. 2) Eosin Methylene Blue agar can be used for enumeration of *E. coli* and *A. aerogenes*. 3) Bismuth Sulfite agar can be used for enumeration of *S. typhosa*. 4) Boston sewage sludge did not contain sufficient numbers of enteric bacteria for quantitative enumeration before and after digestion. 5) Addition of large quantities of enteric bacteria to anaerobic digesters with variable retention periods resulted in a rapid die-off of the enteric bacteria. 6) High-rate digestion of sewage sludge with retention periods between 6 and 20 days should not result in a significant increase in the health hazard from enteric bacteria.

"Survival of Salmonella Typhosa During Anaerobic Digestion." I. Experimental Methods and High-Rate Digester Studies. By Ross E. McKinney, Harold E. Langley, and Henry D. Tomlinson. *Sewage & Industrial Wastes*, December, 1958.

### Television for Sewer Maintenance

The City of Cincinnati recently began the use of a closed circuit television system for scanning the interior of its sewers and sewage regulator chambers. This unique application of the ability of the television camera to "see" and transmit images is an example of how the magic of electronics has been applied to the mundane job of inspecting underground utilities. The television net makes it possible to inspect otherwise inaccessible lines and, thus improve maintenance and operation procedures. The television equipment is housed in a 1-ton cargo trailer. This two-wheeled, rubber-tired vehicle is designed to carry a load not exceeding 2,000 pounds, evenly distributed over the floor. Installed in the front end of the trailer is a Fairbanks-Morse electric light and power plant, gasoline driven. This has 2,000-watt A.C. capacity. A Diamond "Utili-Vue" television camera system is used, consisting of two units—the camera head and the camera control unit. Scene illumination is provided by use of a vidicon with 25 foot-candles minimum intensity. The camera has three stages of video amplification and two stages of blanking amplification. A specially designed handling mechanism is used to control the camera. The mechanism consists of a turntable, a motor driven winch and portable aluminum pole sections, which control the direction of the camera. By operation of a control switch, the camera can be raised or lowered. By rotation of the turntables the camera can be rotated 360 degrees. The connecting cables allow working approximately 1,000 feet distance from the monitor. The cost of the television equipment was $7,223.50, which it is estimated can be saved in two years, due to decreased labor. The value of the equipment, in terms of safety, cannot be measured.

"Cincinnati Televises Its Sewers." By A. D. Caster. *Wastes Engineering*, December, 1958.

### Other Articles

"Four **Financing Methods.**" The four methods of financing in general use in the area covered by the county sanitation districts in Los Angeles County are discussed in this article. By A. M. Rawn. Wastes Engineering, December, 1958.

"Revised Schedule Streamlines **Garbage Collection.**" The City of Winston-Salem streamlined its garbage collection system. This promises to provide a more equitable schedule of garbage collection, a more efficient service to every residential area and a saving of at least $50,000 this fiscal year. By Theodore H. Noe. Public Works, January, 1959.

"**Sanitary Fill** Proves Out For Plant Sites." A report of the successful transformation of San Francisco Bay tidelands into solid ground usable for plant


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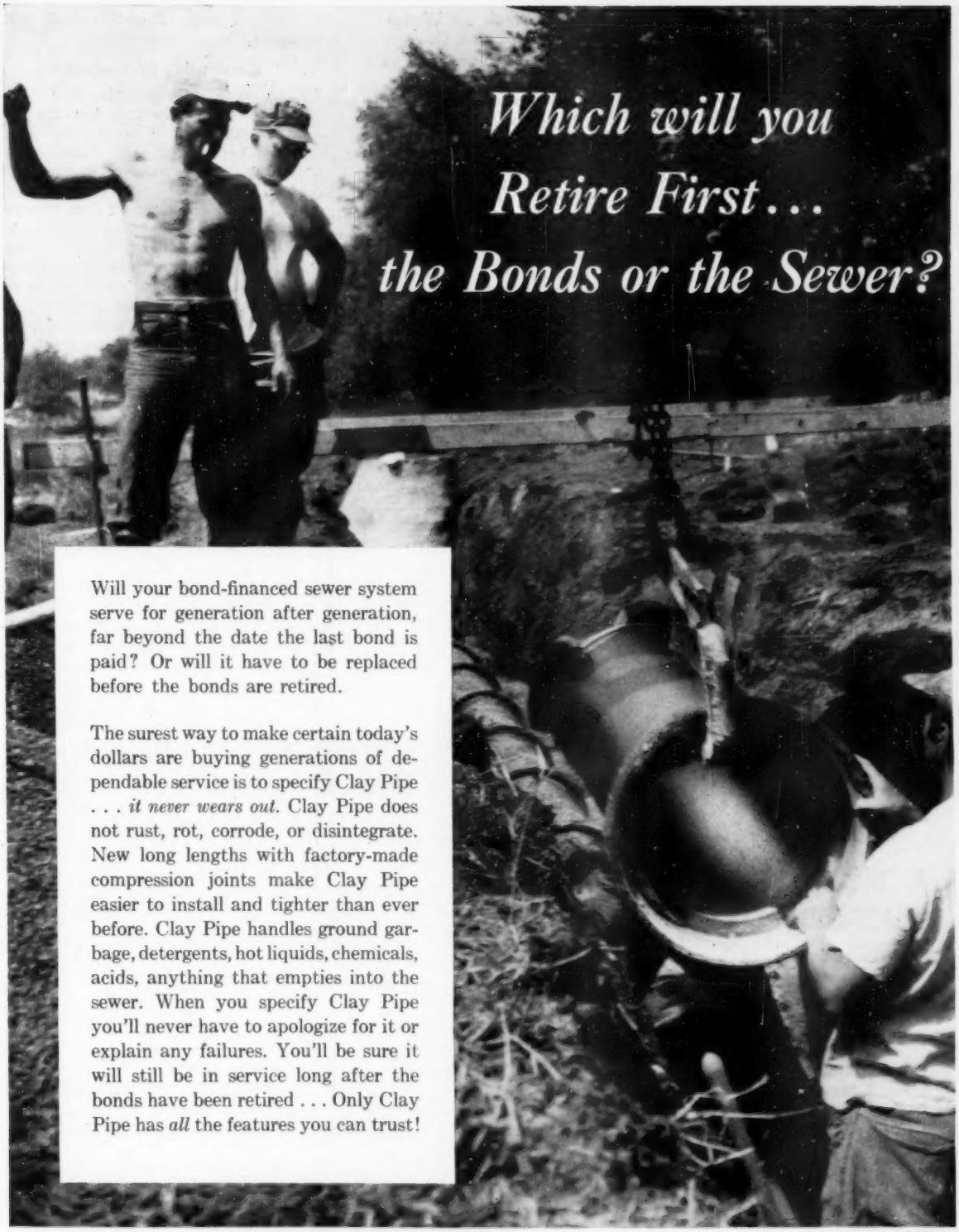


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sites. By Nathan A. Bowers, Engineering News-Record, December 18, 1953.

"**Operator Ingenuity** At the Tacoma, Wash., Sewage Treatment Plant." This paper is primarily concerned with a number of the operational improvements developed by the skill and ingenuity of the operating personnel. By Lyman Ketcham. S&IWA, December, 1958.

"Predacious **Fungus Behavior** In Activated Sludge Systems." This paper describes some laboratory activated sludge units in which the persistence of nitriles was apparently impaired by a predacious fungus, Zoophagus insidians. By Wm. Bridge Cooke and F. J. Ludzack. S&IWA., Dec., 1958.

## Research on Water Evaporation Control

(*Continued from page* 102)

Whitlow of the SRI, as follows: 1) The use of surface floats, rafts, cakes or wick dripping devices are not satisfactory for film forming compound applicators; and applying the film forming agent in a solution, liquid or emulsion form will prove to be more satisfactory than in cake, granular, solid or crystal form; 2) the applicator must be power driven, operated continuously and points of application must be upwind and spaced at very close intervals, possibly not more than 15 to 20 feet apart.

### *Continuing Investigations*

A recent survey by the Soil Conservation Service indicates that in Texas there were, as of early 1958, 341,863 ranch and farm ponds which average 2.72 acre feet in capacity and 0.72 acre in water surface area. Of these probably more than 50 percent are located in the western and southwestern part of the state where evaporation accounts for a large loss of water annually. According to R. L. Lowry, consulting engineer of Austin, annual evaporation in Southwest Texas varies from 60 inches along the central part of the state to 108 inches in the extreme southwestern part, with the average for the area being about 72 vertical inches annually. If the application and maintenance of a monomolecular film over the water surface of the stock ponds reduces evaporation by as much as 33 1/3 percent, the annual saving of 2 vertical feet of water amounts to a total for the state of about 500,000 acre feet or 163 billion gallons. This could mean that the ranch owner may have water in his stock ponds the year around rather than see them dry up during the late summer and early fall.

The Texas A. & M. College Research Foundation, in April, 1958, submitted to the State Board of Water Engineers a proposal for studies of evaporation control covering a one-year program which was estimated to cost a total for the first year up to $25,000. The program for this phase of research work would be devoted mostly to perfection of the dispensing equipment, control of bacterial action, studies of wind and wave action and effects of the covering film on livestock. Duplication of laboratory and other work which has been and is being done by others is, of course, to be avoided. The Foundation has acquired an 1100-acre ranch in Throckmorton County, 100 miles west of Fort Worth, for research in land management.

Extensive field investigations have been carried on at Lake Hefner, a unit of the Oklahoma City water supply by the U. S. Bureau of Reclamation in co-operation with other federal agencies and the Oklahoma City Water Department. Reports of these experiments may be available in the Denver office of the Bureau of Reclamation.

Work on evaporation reduction is being carried on in San Antonio and Eagle Pass by Dr. Russell G. Dress-


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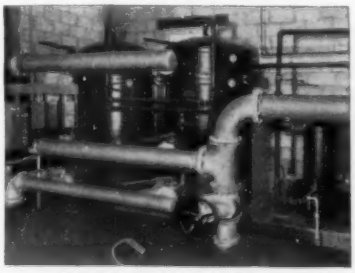
*Shown is a typical Adams SPF Swimming Pool Filter installation. These filters are available in a wide range of sizes for pools of 50,000 to several million gallons capacity. All sizes are normally available from stock. We do not offer a filter for backyard pools.*



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The R. P. Adams Company is the nation's largest manufacturer of filters exclusively for municipal, commercial and institutional pools.

For detailed information, write for our new technical Bulletin 626. It was prepared to help you with your swimming pool filter problems.

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**FILTER BOTTOMS**

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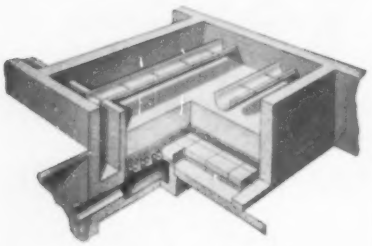


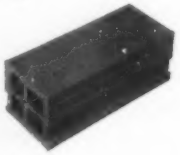
Filter unit showing Leopold Filter Bottom and Leopold Fiberglass-Reinforced Plastic Wash Troughs

**Performance Proved in over 375 plants with a daily capacity of more than 2¼ billion gallons!**

In this design, laterals and distributing blocks form a permanent unit that assures equal filtration and uniform wash distribution with low loss of head. Made of de-aired fire clay—vitrified and salt glazed—the blocks can't corrode, won't absorb water, are acid and alkali resistant, and are not subject to tuberculation.

In addition, the Leopold Filter Bottom needs only a shallow depth of small-sized filter gravel, does not require supporting concrete structures, and is the only design providing a fixed and controlled secondary backwash.

*Literature and Complete Details Furnished on Request!*



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ler, Chemical Process Consultant, who during the past 18 months has accomplished much in the design and building of power driven multiple unit dispensers and application of the film forming agent in liquid form. He used the "Suspension Process" which applies the fatty alcohol, dispersed in a liquid medium, to the reservoir surface. In this form the fatty alcohol is said to be 20,000 times more active than conventional flake material.

The film-forming material is distributed on a reservoir by means of a pump and plastic distribution lines with outlet orifices. The experimental unit, on trial during the spring and summer of 1958, makes the distribution uniformly for one mile along the up-wind shoreline, and will maintain a film on a reservoir of a size up to 1000 acres. For commercial applications on larger reservoirs, larger units or multiple small units may be used.

This process has been tried progressively on a 0.7-acre pond, a two-acre lake, and on 40-acre and 330-acre reservoirs. A considerable number of tests have been performed on the 40-acre reservoir at Eagle Pass, Texas, the results showing 40-60 percent savings of water as compared to the untreated reservoir. Recent cost estimates, based on actual outdoor results show, for reservoirs of from 5000 to 50,000 acres the overall cost of saving water to be $3 to $8 per acre-foot, depending on the individual size and shape of the reservoir.

### *Accomplishments*

The results of more than two years of research work carried on by the Southwest Research Institute in cooperation with the Southwest Water Evaporation Research Council may be summarized briefly as follows:

1) From private sources such as industry, consulting engineers, individuals, city water departments and districts, funds amounting to $44,-110 were provided, none of it being used for overhead or expenses of the council members.

2) Active research work on the program was commenced in January, 1956, and phased out as an active work project in the summer of 1958.

3) State of Texas funds, amounting to about $25,000, have been made available to the Texas State Board of Water Engineers for continuing the research work.

4) The Southwest Water Evaporation Research Council has been incorporated and chartered by the


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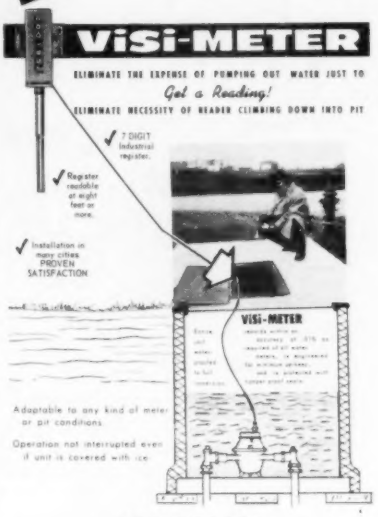
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State of Texas as a non-profit organization for carrying on research and allied work in the field of water conservation.

5) Sufficient laboratory and field work has been done to determine that certain chemical compounds have the property of spreading over a water surface in a thin film of monomolecular thickness. Fatty acids and fatty alcohols of the $C_{12}$-$C_{20}$ carbon chain length are typical. These compounds have in their configuration of atoms an $OH^-$ (hydroxyl) group end of the molecule. The group, being identical to such a group contained in the water molecule, stimulates an affinity between one end of the molecule and the surface of the water. The result, therefore, is an alignment of the fatty film molecule standing on end perpendicular to the water surface, and closely packed. This has the effect of retarding water vapor escape, thus reducing evaporation as long as the molecules so aligned and arranged are held compressed together.

6) It is believed that sufficient laboratory work has been done to establish the fact that by application of such a film to a water surface evaporation can be reduced by upward of 30 percent.

7) Before practical application to large water surfaces, upward of 1000 acres, additional research must be carried on. Some fields worthy of further study are application by aircraft, crop dusting planes and helicopters; slurry application by force pump equipment, wind, gas or electric power driven; application from motor boats, barges or other surface crafts; and hand broadcasting from the up wind shore.

8) Hexadecanol without admixture has been cleared by the Public Health Service for use on public water supply reservoirs as a film forming agent. Unofficial information indicates Public Health Service clearance of octadecanol has been obtained by Dr. Silvey of Denton, Texas.

9) A bibliography listing pertinent literature has been compiled and published in the Final Report of the Southwest Research Institute and is available upon request.

• • •

### Georgia Highway Conference

The 8th Annual Georgia Highway Conference will be held at Georgia Institute of Technology, Atlanta, Ga., on March 9 and 10. Full information is available from Richard Weigand, Director of Short Courses and Conferences of the Institute.


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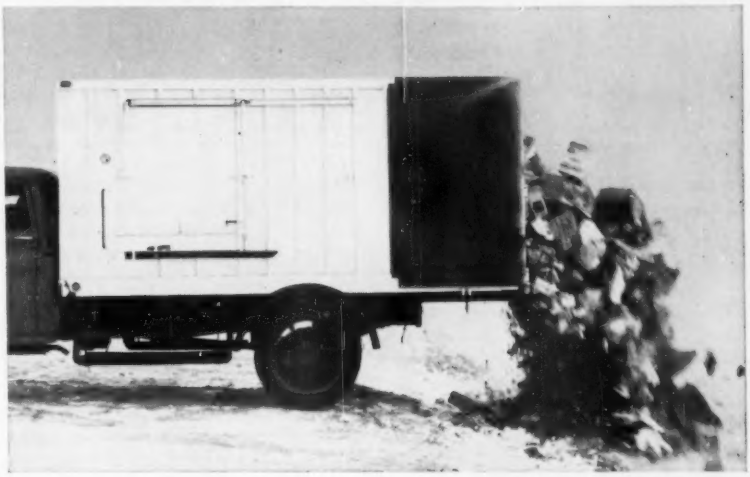

When you consider ALL the factors . . . original cost, cost of operation and maintenance . . . length of hauls . . . number of stops . . . and the tonnage hauled, you'll find the M-B Packer will give you the LOWEST COST PER YARD performance.

**LOWER ORIGINAL COST**

Simplified, side loading quality design, without complicated hydraulics, eliminates dead weight and excessive cost . . . also permits mounting on smaller, less costly truck.

**LOWER OPERATING COSTS**

A smaller truck means up to 30% less gas and oil consumption. And fewer packing cycles means additional fuel savings. You completely eliminate all the high costs associated with hydraulic operation . . . because a simple mechanical packing system is employed. You'll find ALL maintenance costs far lower too . . . and less frequently needed.

**PACKS GREATER YARDAGE**

Powerful progressive compaction gives you big full body capacity loads fast . . . packs anything . . . one haul does it all. Before you buy any packer, ask for a demonstration of the M-B *first*, for lower cost per ton refuse handling.

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**SAFEST UNIT YOU CAN BUY!**

**LOADING DOOR LATCH**

Only M-B offers positive safety latches on the loading doors, keeping the packing plate from moving if the doors are open.

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Collectors need not step into the street to load, endangered by passing traffic. It's easier for the driver to see the men while loading or riding to the next stop.

**FULLY ENCLOSED MECHANISM**

No outside moving parts to trap collectors or bystanders . . . no "safety" doors that can be braced open.

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Rear doors unlatch from the side, keeping men clear of the load. Unit cannot be "up-ended" when unloading because body is not raised.

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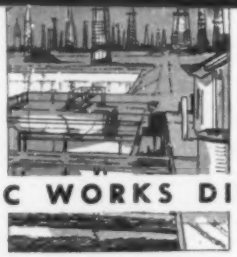


PUBLIC WORKS DIGESTS

*Prepared by*
CLAYTON H. BILLINGS
Associate Editor

# THE INDUSTRIAL WASTE DIGEST

### Diversified Treatment Of Auto Wastes

This is the second of two articles on the waste pretreatment plant of the Pontiac Motors Division of General Motors. The first dealt with cyanide waste treatment. A survey showed the alkaline waste flow to exceed that of acid wastes and that the pH of the combination could ordinarily be tolerated in the sewers. To meet emergencies, however, a pH-controlled acid feed arrangement was provided. The sulfur dioxide method was selected for removal of hexavalent chromium from the metallic-acid wastes. Provision was made for the application of $SO_2$ in the ratio of 5.25 pounds to one of chromium. These wastes are collected in holding tanks and batch treated by the operator according to analysis of each holding tank when full. The alkali-oily wastes are piped to a clarifier where free oil is skimmed off and sludge is removed. They are then treated by flotation to break emulsions. Ferrous sulfate and lime are used. Sludge formed in the cyanide waste treatment by the oil emulsion breaking and clarification are subjected to thickening and vacuum filtration. The two vacuum filters are equipped with 150 sq. ft. each of nylon cloth medium and handle about 35,000 gallons of 6.4 percent solids sludge per day, reducing the moisture content to about 76 percent. The operating building is equipped with a graphic control panel containing switches for every electrically driven unit, level indicators and pH and ORP recorders.

"Auto Wastes Pretreated for Discharge to City Sewers." By E. B. Besselievre. *Wastes Engineering*, December, 1958.

### Waste Acid Recovery

There are now two proved methods for regenerating or reconstituting acids—complete combustion or spray burning and indirect combustion. In the former, waste acid is sprayed into a combustion chamber heated to 1700° to 2000° F, with slight excess air. The sulfur present is converted to sulfur dioxide and some sulfur trioxide. Hydrocarbons decompose to $CO_2$ and water. Water is eliminated from the gases by cooling them and passing them through a drying tower. The sulfur dioxide is then converted to the trioxide by the orthodox contact process and the gas is passed to an absorber to make sulfuric acid.

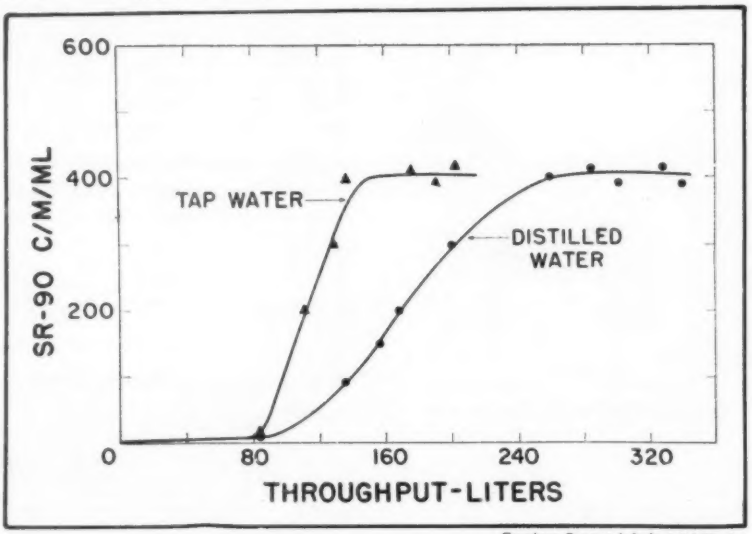
In the indirect combustion method, the gases are evolved by adding the acid sludge to granular by-product coke being circulated in a mixer with the application of heat. Most of the hydrocarbons are converted to coke. The remainder and sulfur are oxidized in the combustion chamber. The gases are cooled and dried as in the spray burning process, and the sulfuric acid conversion takes place by the contact process.

When $H_2S$ and elemental sulfur are present, the needs for supplementary fuel are lessened in the spray burning process. The ratio of acid to hydrocarbon influences the necessity of using other fuels to support combustion. A low ratio has less effect on the plant investment in the indirect combustion method than in the spray burning process. The sale of by-product coke is a credit in favor of the former method.

"Disposal of Refinery Waste Sulfuric Acid." By T. R. Harris. *Industrial and Engineering Chemistry*, December, 1958.

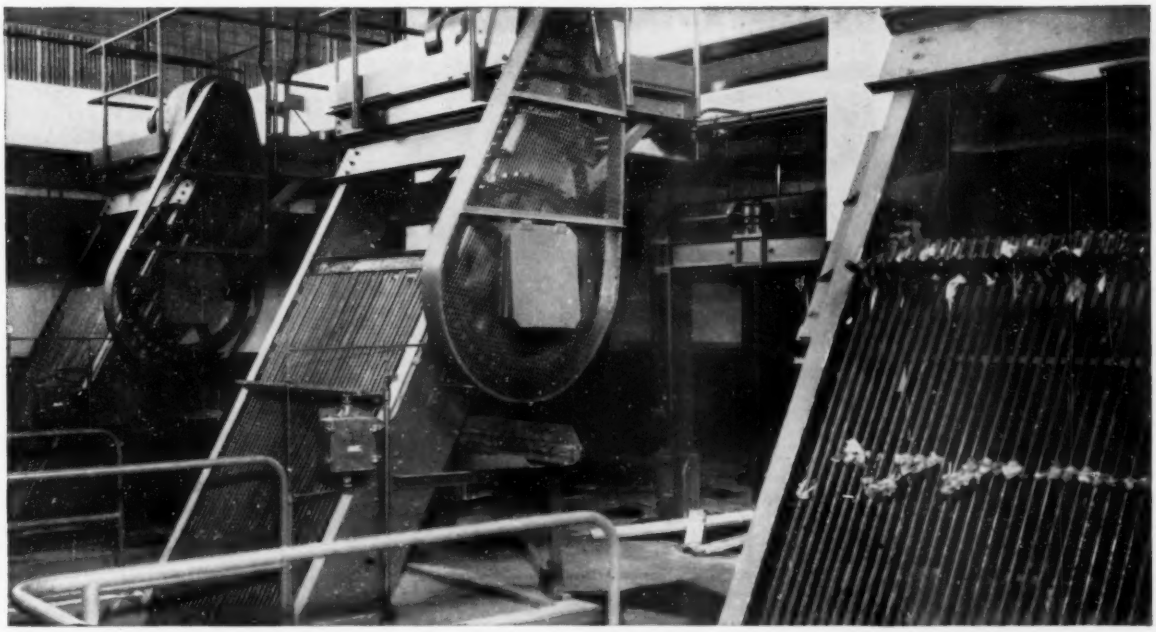
### Acetylene as an Air Contaminant

Acetylene may be present in air from traffic gases and as a result of its widespread use as a basic chemical. Its determination might serve as an index of pollution from traffic gases or as a means of monitoring areas where acetylene is used or made. A test was developed as a compromise between the ideal quick, easy method and tedious laboratory determinations. It is based on the modified method of Berthelot involving precipitation of copper acetylide with an ammoniacal solution of cuprous chloride. Recent adaptations used acetone for dissolving the sampled acetylene and determining it colorimetrically after adding the cuprous ion. While this method is excellent for concentrations above 1 ppm, it was not considered suitable to detect acetylene in concentrations in the parts per billion range. By using silica gel for adsorbing acetylene from a gas stream, the authors were able to determine concentrations as low as 10 ppb. The gel column,




Courtesy Sewage & Industrial Wastes

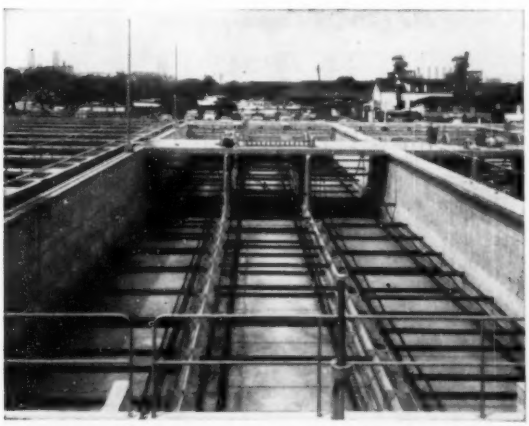
● **SOIL adsorption capacity of tuff for $Sr^{90}$ is influenced by the presence of ions. $Sr^{90}$ appears in the effluent earlier in a tap water solvent.** **See page 165.**



**No jamming at bottom of screens** *with mechanically back-cleaned Jeffrey Bar Screens. Rake lifts off accumulated screenings as the flow enters bars.*

# *Again...* Bowery Bay Plant chooses Jeffrey sewage treatment equipment

Confidence in the efficiency and reliability of Jeffrey sewage treatment equipment resulted in its use in the original 40 mgd Bowery Bay Plant... when the World's Fair triggered New York City's long range attack on harbor pollution. Selection of Jeffrey Bar Screens and Collectors for the recent big extension of plant capacity (now 120 mgd) testifies to the performance record of the 18-year-old Jeffrey equipment.



**Jeffrey Collectors** *were specified for 6 primary settling tanks and 8 final tanks added at Bowery Bay. Under ordinary conditions, mechanical disturbance can be limited to less than 1 hour in 24, due to large carrying capacity.*

**Jeffrey Bar Screens**—Nine of these mechanically back-cleaned bar screens have been added to facilities at Bowery Bay. Rakes enter from discharge side and project through bars as they travel from bottom toward headshaft. Screenings are carried over the top and drop off as rakes leave the screen bars.

If screenings accumulate rake lifts them off as it enters the bars. This action virtually eliminates jamming at the bottom of the screen.

**Primary and Final Settling Tanks**—Rectangular tanks, equipped with Jeffrey Collectors, have proved to be the most efficient sedimentation device ever designed. Stable conditions of flow make possible maximum solids removal in tanks of minimum size. Simplicity and ruggedness of Jeffrey Collectors assure long life and trouble free operation.

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10 mm long and 2 mm in diameter can be placed in 1 cm tubing in the path of an air stream from the sample and cooled to dry ice temperature. The gel is then warmed to room temperature and is treated with ammoniacal cuprous chloride. The depth of color produced on the gel is indicative of the quantity of acetylene adsorbed.

"Determination of Acetylene in Air in Concentrations from 10 ppb to 10 ppm." By E. E. Hughes and R. Gorden, Jr. *Analytical Chemistry*, January, 1959.

### Total Oxidation Of Canning Wastes

In order to determine the effectiveness on canning waste of the total oxidation process developed by R. R. Kountz of Pennsylvania State University, a pilot plant was established at the Exeter (Ontario) plant of Canadian Canners, Ltd. The plant consisted of a tank of 1500 gallons capacity for sludge contact, a Dowpac tower of 10 sq. ft. cross section and 63 inches high, a pump and vibrating screen. Nutrients were added at the rate of 3 pounds of nitrogen and 1 pound of phosphorous for each 100 pounds of 5 day BOD. Activated sludge was obtained from an established sewage treatment plant. The initial suspended solids was 1026 mg/L and sludge volume index was 118. In two weeks these were built up to 6448 mg/L and 265 to 152 respectively. The results for pea canning waste indicated 40 to 50 pounds BOD per day a satisfactory loading. Pea stack waste in the early stages of fermentation or diluted with corn waste can be satisfactorily treated. The sludge produced was stable and had the capacity to recover quickly. The power consumption per pound of COD was estimated at 0.7 kwh.

"Total Oxidation as Applied to Cannery Waste." By J. G. Duncan. *Papers Presented at Fifth Ontario Industrial Waste Conference*, May, 1958.

### Robotry for the Cyclator

Wastes from a paper coating mill at Georgetown, Ontario, consist of 14,000 to 15,000 gallons per day of precipitated mud containing coagulating chemicals, clay, casein, latex and starch; and waste "colour", the liquid material applied to coat the paper. The colour has a solids content of 30 percent, clay and the same organic materials as the precipitated mud. Investigation of methods of treating the wastes led to the installation of an Infilco Cyclator for removal of solids by coagulation with alum and calcium chloride. The application of automatic controls was complicated by the start-stop operation of the waste discharge. The basic controls developed were a bubble tube for the surge tank and an interval timer for mud discharge. The former operates a pressure switch which actuates the progressing cavity pump and the interval timer. The timer makes an electrical connection to operate a mud pump on an adjustable percentage of a 15-minute cycle. The bubble tube pressure switch also operates the proportioning chemical feed pumps and a running time meter to measure chemical flows. Instruments include a level recorder for the surge tank and a continuous recording turbidimeter to measure turbidity in the upper part of the sedimentation tank. The latter is to be developed and installed later. An alarm actuated by a pressure switch warns of flooding of the surge tank. It is expected that labor saving will be appreciable and that the system may be left unattended for days or weeks at a time. A plan of preventive maintenance has been adopted to assure good operating conditions.

"Factors Involved in Applying Au-


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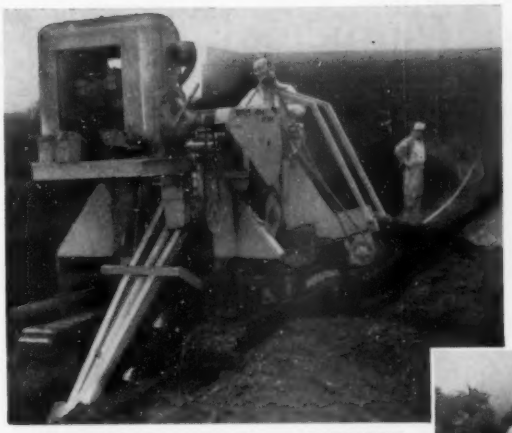
tomatic Control to an Infilco Cyclator." By H. M. McFarlane, J. R. Gunning and A. E. L. Maughan. *Papers Presented at Fifth Ontario Industrial Waste Conference*, May, 1958.

### Soil Adsorption Of Radionuclides

As a result of continuous monitoring of soils receiving waste discharge in the past at the Los Alamos Scientific Laboratory, some movement of plutonium had been detected. An investigation was undertaken to determine the rate of travel and consequently the adsorptive characteristics of the local soils with respect to plutonium, strontium-90 and cesium-137. Cores were cut from unweathered rock and were subjected to application of solutions of nuclides of known concentration. When increasing radioactivity of the effluent indicated breakthrough of the nuclide and, accordingly, diminished adsorptive ability of the soil (tuff) the core was dismantled, dried and autoradiographs made to determine the distribution of the nuclide. It was determined that the tuff has a high retention capacity for radioactive materials, significant in that its ion exchange capacity is about as low as any found in nature. $Cs^{137}$ and $Pu^{239}$ are very tightly bound to the tuff and resist leaching. $Sr^{90}$ is much more easily released. Comparison of the breakthrough points of $Sr^{90}$ in tap water solutions and that in distilled water solutions showed the former to occur more quickly. This led to investigation of the leaching ability of various mineral ions in water. It was found that calcium, magnesium, barium and carbon dioxide solutions readily leached $Sr^{90}$ from the tuff. It was concluded that disposal of this isotope to soils is to be undertaken with extreme caution and only with foreknowledge of the nature of the soil and its capacity for ions known to be present in a waste. A disposal area must be carefully guarded to avoid the discharge of other wastes that may contain ions with a capacity to dislodge the previously adsorbed nuclide. Regarding plutonium, from what is known about its chemistry, it is entirely possible that this nuclide could be released at some future time by inadvertent discharge of solutions such as versene in the same area.

"Soil Adsorption of Radioactive Wastes at Los Alamos." By C. W. Christenson, E. B. Fowler, G. L. Johnson, E. H. Rex and F. A. Virgil. *Sewage and Industrial Wastes*, December, 1958.

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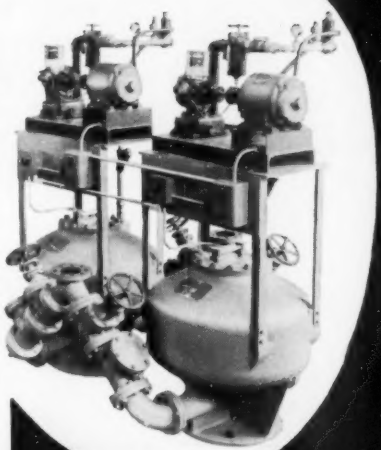

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# Composting Municipal Refuse

COMPOST MAY be produced from municipal refuse including garbage, organic rubbish, and other organic litter; from such organic industrial wastes as those from food processing; from sawdust and wood chips; and from sewage sludge. In planning a composting operation from these raw materials, several factors are fundamental to its success. Gotaas has discussed these in detail in his summary of composting prepared for the World Health Organization. They are, in brief:

*Segregation of Refuse and Salvage.* Noncompostable materials, such as tin cans, ferrous and nonferrous metals, glass, china and pieces of concrete, should be removed from the refuse before or after composting. Some of these materials, along with rags and bones, may be salvaged and produce considerable return.

*Shredding of Refuse.* The most desirable size of particles for composting is less than 2 in. in the largest diameter. Larger particles can be composted satisfactorily but some shredding will be required, the amount depending on the use of the final product. Shredding of refuse converts most objectionable odors to the smell of freshly cut vegetables.

*Carbon-Nitrogen Relationships.* A proper carbon to nitrogen (C/N) ratio is important to ensure rapid and complete biological decomposition. For composting operations, the ratio of available carbon to nitrogen should be about 30:1 for optimum results. (The carbon in lignin is not readily available.) Higher ratios indicate a nitrogen deficiency and lower ratios a nitrogen excess. Successful operations can be carried out with materials having higher ratios, but a longer time is required. Under such conditions, sewage sludge is often added to the refuse to lower the C/N ratio. At lower ratios, composting is rapid and complete, but nitrogen may be lost in the form of ammonia.

The C/N ratio (available carbon) of the finished product is also important. If this ratio exceeds 20:1, the compost will continue to decompose and if used as a soil conditioner will rob the soil of nitrogen.

*Moisture Content.* For optimum composting the moisture content of the composting material should be between 40 percent and 60 percent by weight. Decomposition proceeds quite normally at higher moisture contents if adequate aeration can be provided. At lower moisture contents, biological activity is inhibited as the organisms are deprived of water needed for their metabolism.

During aerobic composting there is a rapid rise in temperature to 55° to 70° C in the first three days, followed by a steady decline as organic matter is stabilized. Opinions differ regarding the optimum composting temperature. Many operators favor 60° to 70° C. The Dano Corporation believes that the maximum rate of decomposition, as measured by rate of carbon dioxide production occurs between 45° and 50° C.

*Aeration.* Aeration is necessary for aerobic composting in order to obtain the rapid, nuisance-free decomposition which is characteristic of the process. Without sufficient air (oxygen) the process becomes anaerobic and continuous, but with the production of objectionable odors. Aeration is also useful in re-


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ducing a high initial moisture content in composting materials. Inadequate aeration will lengthen the time required for composting.

*Time Required for Composting.* The time required for satisfactory stabilization of organic refuse depends upon (a) the particle size; (b) the initial C/N ratio; (c) the moisture content; and (d) the maintenance of aerobic conditions. In present composting operations, time required will vary from 5 days to several months. The Dano Corporation believes that decomposition in their Bio-stabilizer, measured as rate of carbon dioxide production, reaches a peak in 2½ days and is substantially complete in 5 days. Other operators with different processes use times varying rom 3 to 6 weeks.

*Use of Inocula.* Composting developments, particularly in the United States, have been accompanied by considerable discussion of the importance of special inocula that are supposed to hasten the decomposition of organic matter. Gotaas cites many references to experiments which prove that the number of bacteria is seldom a limiting factor in composting; if the environment is right, the indigenous bacteria, which are much better adapted than forms attenuated under laboratory conditions, will multiply rapidly. The experiments show that nothing is gained by the addition of special inocula to the compost pile. This evidence is supported by the fact that most of the successful European composting operations do not use special inocula.

Composting installations were observed in Switzerland, The Netherlands, Scotland, Denmark and the

**TABLE 1—Estimated U. S. Costs for a Refuse Plant Handling 50 Tons of Refuse per Day for Approximately 50,000 People**

| *Cost Item* | *Dano* | *VAM* | *Jersey* |
|---|---|---|---|
| Capital | | | |
| Land | $ 20,000 | $ 32,000 | $ 24,000 |
| Buildings | 50,000 | | |
| Equipment | 225,000 | 400,000 | 650,000 |
| Trucks and loader | 10,000 | 10,000 | 10,000 |
| Total | $305,000 | $442,000 | $684,000 |
| Amortization | | | |
| 15 years at 5% | $ 29,350 | $ 42,600 | $ 65,000 |
| Operating | | | |
| Labor | | | |
| Foreman | (1) 6,000 | (1) 6,000 | (1) 6,000 |
| Unskilled | (2) 6,600 | (4) 13,200 | (11) 36,300 |
| Power | 3,600 | 1,750 | 1,370 |
| Rolling Stock | 4,350 | 4,350 | 5,000 |
| Maintenance | 2,750 | 6,950 | 12,000* |
| Total Operating | $ 23,300 | $ 32,250 | $ 60,670 |
| Total yearly cost | $ 52,650 | $ 74,850 | $125,670 |
| Cost/year/ton refuse | $ 2.88 | $ 4.10 | $ 6.88 |

*Estimated, no figures available.

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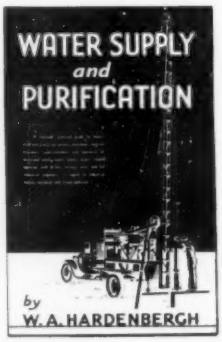


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Isle of Jersey. Three methods were principally in use. These were the Dano process which utilizes grinding of refuse and a rotating steel cylinder; the VAM process employs grinding and composting in windrows; the Isle of Jersey procedure involves separation and preparation of the refuse, mixing with digested sewage sludge and composting by mechanical aeration in a vertical silo and by storage in windrows.

These methods are described in detail in the Bulletin and a cost estimate is given for their use under United States Conditions. The cost data are summarized in Table I. They include capital, amortization and on-the-site operating costs, but do not include collection and transportation charges. As disposal of the compost is an unknown quantity, no allowance is made for either its value or its cost of disposal. An allowance is made for the cost of disposal of uncompostable material by dumping or incineration as practiced in European operations; however, this cost will be higher in the United States as European refuse contains about 20 percent non-compostable material and U. S. refuse about 50 percent.

*This is a report on an investigation made by John B. Nesbitt, Ass't. Professor of Civil Engineering, Pennsylvania State University. Made possible by a grant to the University, the investigation included first hand visits to European installations. The full report is published as Engineering Research Bulletin B 72 (price $1) by the College of Engineering and Architecture, University Park, Pa.*

• • •

### Public Works in Columbia, S.C.

In addition to 34 blocks of street resurfacing with asphaltic concrete and construction of 4,034 ft. of 18-inch water mains for the Leesburg water district, public works activities in Columbia, S. C., during October, 1958, included:

Installation of 636 feet of storm drains, 13 water services, 1,008 feet of sewers, 43 sewer services, 4 street lights and a radio set; repair of 81 water meters, 39 sewers, 30 waterlines, 85 miles of streets and eight miles of sidewalks; collection of 10,348 tons of garbage and 1,114 loads of trash; and servicing of 418 city vehicles. The water plant pumped and treated 467,294,000 gallons of water during the month, while the Tree Division trimmed 122 trees and hauled 195 loads of logs and brush.


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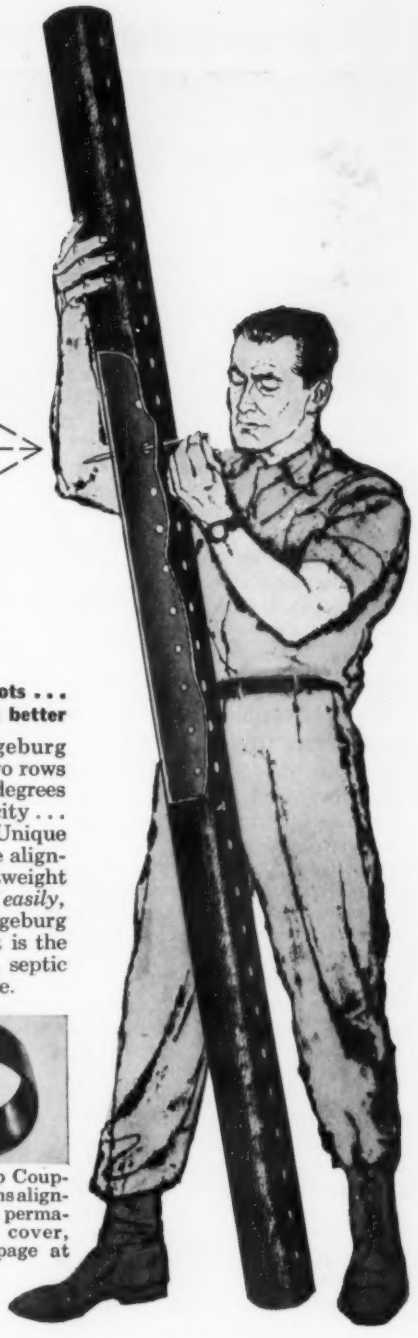

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## Turnpike Service Area Illumination

THIS service area on the recently opened Connecticut Turnpike is illuminated by General Electric fluorescent luminaires to provide added safety for motorists pulling onto and off the busy turnpike at night. The lighting system also serves as a long-distance "beacon" for night motorists, alerting them well in advance that they are approaching a service area. The four-lamp, six-foot General Electric units are mounted back to back on concrete standards at heights of approximately 25 feet. The fluorescent light pattern provides uniform, virtually glarefree, illumination throughout the parking areas.

### Synthetic Rubber in Pavement Permits Quicker Stopping

Quicker stopping in locked-wheel skids is possible on roads where neoprene has been added to ashpalt surface treatment, according to tests reported by the DuPont Company. In "panic stops" at 40 mph, a test car averaged 94 ft. braking distance before coming to a complete halt on unmodified asphalt and stone chip surfaces of a commonly used type. On a road where 1½ percent of neoprene had been added to the asphalt, the stopping distance was less than 84 ft.

The increased stopping efficiency in a 30-mph test was determined to be 16 percent greater than that of conventional material. The advantage apparently resulted from the greater ability of the neoprene-modified coating to hold stone chips, plus decreased "bleed-through" to the surface.

The tests showed that the differential in braking effectiveness increased with speed. Tests also showed that wet pavements did not reduce superiority of the neoprene-modified asphalt.

Testing was done on a road laid by the Delaware Highway Dept. in August, 1957. Both neoprene-modified and control sections had been in service for almost a year when the tests were made in July, 1958. Accurate measurements of distances and time were made through use of an electric timer mounted in the car, a special speedometer connected to a fifth wheel behind the car and an explosive cartridge on the rear bumper to fire a pellet of yellow paint onto the road surface the instant the brake was applied.

• • •

### Refuse Collection for an Industry

Bulk refuse collection at the Rohr Aircraft Corp. plant in Riverside, Calif., has been facilitated by the Econ-O-Packer system's truck mounted refuse compaction body and "Econ-O-Bin" detachable trash containers. In use since the Fall of 1958, the system has reduced the cost of handling plant refuse and has resulted in improved plant cleanliness, fire protection and sanitation. Units of the Econ-O-Packer system are manufactured by Econ-O-Way, Inc., San Diego, Calif.

● **ECON-O-PACKER in operation.**

### Community Financial Plan

(*Continued from page* 107)

financial expert can make are usually quite limited—and most of those he can offer are painful.

#### *Political Realities*

Financial planning must take account of the illogical and complex structure of local government. As a result of historical accidents, counties, cities, villages, townships, school districts, sanitary districts, special districts and authorities overlap and bump each other without pattern. The core city and its suburbs are likely to think of themselves as competitors, and to some extent they are. Neighboring suburbs often have conflicting interests, and friction between overlapping and underlying units is not unknown. The financial plan must, of course, be suited to needs of the particular jurisdiction, but if it is to make the maximum contribution to development of the area, it must be drawn in such a way that it can become a part of an integral overall financial plan. Provision should be made for regular revision—although piece-meal changes and compromises should be avoided. Flexibility in regard to administration is also necessary so that each issue can be tailored to meet the whims of the capital market as it exists when the offering is made.

Before the financial plan can be formulated a considerable amount of information must be assembled and analyzed. Ordinarily this does not require the gathering of much new data. In the preparation of the physical plan and the capital budget a large proportion of the needed information will have been compiled. In fact one of the major tasks of the financial analyst at this point is the elimination of material irrelevant for this particular problem. The scope of this portion of the inquiry is indicated by the outline which follows. Since the outline is intended merely as a point of departure, for all good financial plans are custom made, it has purposely been kept brief.

I. Review of the economic background of the area should include both the metropolitan area and the relationship of the particular jurisdiction to other jurisdictions providing services in the same region. What type of community; its size; has the population been growing; what are the basic sources of income of the taxpayers; what are the trends; how stable are these incomes; what future growth is expected in the next ten and twenty

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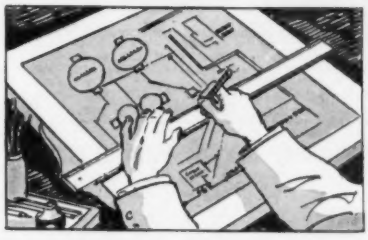

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years; is this section likely to gain or lose in relation to other areas.

II. Are existing public facilities adequate or, as more often stated, how large is the backlog; what are the probable requirements for replacement and growth over the next ten or twenty years? As already indicated this part of the study must be developed in conjunction with the work of the engineers and architects who will provide most of the data.

III. What are the main sources of revenue to this particular jurisdiction (taxes or grants); are they stable; can they be increased; what are the main items of expense; is the budget balanced and can it be kept balanced; how heavy a burden is the existing debt service; what will it be when the proposed new improvements are financed; can this heavier burden be handled in a serious recession; what is the maturity distribution of outstanding issues?

### *Needs and Ability to Pay*

While the financial analysts are studying the present position and its probable future, the physical planners and the engineers should be gathering material on needs for new capital facilities. The importance of this phase of planning and the steps in the planning process have set forth in "Planning for Public Works" prepared under the supervision of Major General John S. Bragdon, Special Assistant to the President for Public Works Planning. In all probability the needs, as developed under these studies, will be greater than the unit can finance under existing law and traditions. This presents difficult and perplexing problems for the administrative officials. Pressures in favor of the new improvements are likely to be very strong, but opposed to this is the growing antagonism toward heavier taxes.

The handling of this difference of viewpoint is a real test of the ability of the local officials. There are a number of possible methods of handling the gap between "needs" and "means". The standards of service may be cut thereby reducing the needs. The laws may be changed in a way which will allow the jurisdiction to collect more taxes or create more debt. There are numerous methods of evading the tax and debt limitations. It is sometimes possible to get certain levies or debt exempted from the limits. New districts and authorities may be formed. In a limited number of exceptional cases this type of governmental unit can make

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an important contribution, but when used as mere evasion the cost is likely to be great. Investors are sophisticated and refuse to purchase bonds issued under such circumstances except at a price concession.

The earlier a financial plan is started, the better. In fact, it seems best to consider the engineering and financial plans as opposite sides of the same coin to be developed more or less simultaneously. The problems facing the various jurisdictions are so individual that each plan must be custom made, and the possibilities for successful shortcuts will remain limited as long as the population continues to expand rapidly, and the role of the local government continues to grow.

*Editor's Note*: This is the second of four articles by Mr. Severson.

• • •

### Sewer Inspection by TV

(*Continued from page* 115)

Occasionally the camera has been lowered into manholes having numerous inlets, subjecting the camera and case to possible immersion. The case is so constructed that it can be submerged in water for short periods of time without damage. This is helpful when making inspections of the outfall sewer. The outfalls are specially designed so that river silt will not settle and bury them. The camera is useful to see that the jets for protecting the sewer outlets are not clogged and are working properly. The unit may also be lowered into areas where steam and vapors are present. Such conditions are encountered often in manholes or regulators where sewage flows through them.

The television unit is useful for training or public relations work involving inspection in confined spaces. Examples are studying incinerators, the operation of rabble arms and the operation of the crank shaft of a diesel generator. Similarly, in the laboratory the television camera can be installed in a refrigerator or incubator.

#### *Equipment Used*

The television equipment is housed in a one-ton, two-wheel cargo trailer. This rubber-tired vehicle is designed to carry a load not exceeding 2,000 pounds evenly distributed over the floor. Two combinations of running lights and caution lights are installed, powered by the pulling equipment. The wheels are equipped with parking brakes which are operated by a hand lever located on the right side of the trailer near the rear of the body.

Special ratchet type supports operated by individual hand cranks are installed at each corner of the trailer bed for leveling and securing the trailer bed in a firm position. An aluminum frame projects above the trailer sides upon which a canvas cover is attached. A 300-watt, 110-volt spotlight is used for lighting the working area of the trailer bed.

Installed in the front end of the trailer is a 2000-watt AC Fairbanks-Morse electric light and power plant, gasoline driven. It maintains 115-volt, 60-cycle, single phase current, with a full load capacity, 17.4 amps at 3600 RPM.

The television system is a Diamond "Utili Vue", Model 500, with a Type 60-6 camera and Type 61-6 camera control unit. The control unit and monitor are installed in a frame which is equipped with rubber shock mounts. The camera, control and monitor are all grounded back to the power generator. In addition arrangements have been made so that external power can be used on the trailer if desired.

Two 150-watt flood lamps are attached to the pole support for illumination purposes. The power to these lamps is supplied through the coaxial cable. The camera control unit consists of a portable frame, which runs on tracks and can be pulled back over the tail gate of the trailer. This mechanism consists of a turn table, a motor driven cable winch and portable aluminum pole sections which control the direction of the camera. By operation of a switch the camera can be raised or lowered. The turn tables permit the camera to be rotated 360 degrees. This entire unit was designed and manufactured by the Diamond Power Specialty Corporation of Lancaster, Ohio, from basic designs of the writer and his associates. A portable unit for use in areas where the trailer cannot be taken has been built by the Sewage Disposal Section. The connecting cables allow working approximately 1000 ft. away from the monitor.

The total cost was $7,223.50, of which $50 was spent for an Army surplus cargo trailer, $3,500 for the trailer-mounted raising and lowering mechanism, and $3,673.50 for the camera and monitor complete and mounted. It is estimated the cost of the unit will be saved in two years due to decreased labor. Safety cost cannot be measured.

The description of the television camera and monitor was prepared by Leo Krapp and Ott Lindeman of the Maintenance Department of Sewage Disposal.


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# PUBLIC WORKS
# EQUIPMENT NEWS

**Safety** device for night-time driving

### "Codit" Reflective Liquid

A new white "Codit" brand reflective liquid which can be brushed, rolled or sprayed on rough or porous surfaces to make them brightly visible at night has been announced by 3M. The liquid is white by day, blending with concrete and other light-colored backgrounds such as bridge abutments, curbs, fence posts and road delineators. At night it vividly reflects the lights of approaching cars to make the object visible to drivers. It can be applied to rough metals, wood, concrete, trees and rocks, and performs well for periods up to two years without attention. Further information is available from Minnesota Mining and Mfg. Co., 900 Bush Ave., St. Paul 6, Minn., or circle **No. 2-1** on the reply card.

### Small Truck-Crane Economically Handles Medium Loads

The Handilift, a hydraulically-operated, truck-mounted crane for handling medium-light loads has been announced by Teale and Co. Easy-to-mount on any truck, including light pick-ups, the unit can be placed directly behind the cab, in the middle of the bed, or on the rear of the truck. It will lift 650 lbs. with a regular 7-ft. boom, or 450 lbs. with a 10-ft. boom. It takes in up to 16 ft. of line by means of an hydraulic winching cylinder inside the boom. A second heavy-duty cylinder tilts the boom up and down. An optional hydraulic unit is available for swinging the boom, or the boom can be swung manually. The crane can be operated with truck PTO or by an auxiliary engine. More data available from Teale and Co., P. O. Box 308, Omaha, Nebr., or circle **No. 2-2** on the reply card.

### Electric Generating Plant

A new 750-watt electric generating plant has been developed by Jeta, Inc. The new unit is a 4-pole generator, single-phase, 60-cycle, 115-volt AC plant with a speed of 1800 rpm. Completely portable, the generator is for general power use. Each unit weighs 104 pounds. More details from Jeta, Inc., Yonkers, N. Y., or circle **No. 2-3** on the reply card.

## Self-Erecting Portable Asphalt Plant

Combining high production capacity with full portability, Standard's new Model S-E, Self-Erecting portable asphalt plant is announced by Standard Steel Corp. The plant is being offered in batch capacities of 4,000, 5,000 and 6,000 lbs. The unit can be set up and made ready for operation in as short a time as 2 or 3 days. The units of the plant travel on wheels to the job site, including the mixing unit, dryer, dust collector, feeder, storage tanks, hot oil heater, etc. The mobile mixing unit is pulled directly under the hoist section. The plant then lifts itself up by its own "boot" straps through the use of a self-erecting power device, without the use of a crane. Complete details from Standard Steel Corp., 5001 South Boyle Ave., Los Angeles 58, Calif., or circle **No. 2-4** on the reply card.

**Plants** can be set up and made ready for production without using a crane

**Buckets** for the new Hough Payloader range in size from 2/3 to 2 cu. yds.

### Hough Announces New H-30R Payloader

The Model HF Payloader made by the Frank G. Hough Co. is being replaced by the new H-30R model. The unit has a carry capacity of 3,000 lbs. at average operating speeds and is a rear-wheel-drive, front-wheel-steer machine. Buckets from 2/3 to 2 cu. yds. are offered for handling of various materials. It is powered by a six cylinder Hercules gasoline engine developing 66.5 hp at 2,200 rpm. Complete specifications from The Frank G. Hough Co., 761 Seventh Ave., Libertyville, Ill., or write **No. 2-5** on the reply card.

### Luminaire for Streets and Highways

Called the Hi-Lite by Magni Flood, this luminaire is made of polyester plastic, reinforced with molded glass and the bowl is made of molded clear acrylic plastic. Reflector and socket assemblies are fabricated from aluminum, oxidized and polished to a high tarnish-resistant finish. With two 4-ft. Power-Groove lamps, and remote ballast, the installer need carry a load of only 15 pounds with him when installing the fixture. Light is engineered for a uniform elliptical pattern which can be increased by the addition of top reflector cut-off plates and internal 75° angled reflectors, making this especially suitable for driveways, parking areas and streets and highways. Complete information is available from Magni Flood, Inc., Dept. NP., 50 Crary Avenue, Mt. Vernon, N. Y., or circle **No. 2-6** on the reply card.

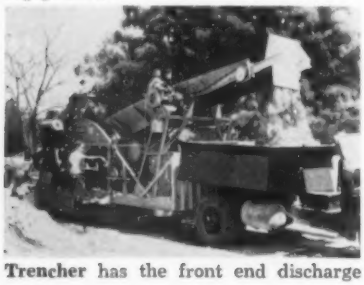
## Allis-Chalmers Motor Scrapers

**Scrapers** are powered by 6-cylinder diesel engines that develop 230 hp at 2000 rpm

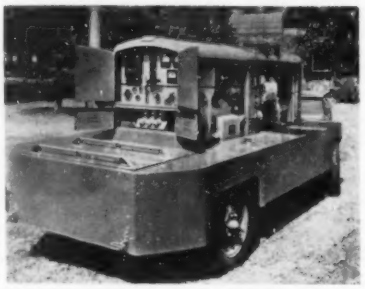
Allis-Chalmers has announced a new medium-sized motor scraper, the TS-260, a 44,800-lb. unit with 12.5-cu. yd. struck and 17-cu. yd. heaped capacity. The tractor is powered by a six-cylinder diesel engine developing 230 hp at 2000 rpm. The scraper is hydraulically operated and its source of power is derived from the gear-type pump driven from the rear of the engine crankshaft. Design of the scraper bowl is wide and low—116 ins. wide and 53 ins. high for fast, easy loading. It also features positive, forced ejection of material with an apron opening of 100 ins., providing maximum spreading efficiency. The 90° steering system permits a 180° turn in approximately 29 ft., making the TS-260 an ideal unit to operate where space is relatively limited. For more details write Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc., or circle **No. 2-8** on the reply card.

### Parsons 250 Trenchliner with Front End Discharge

A front end discharge conveyor that loads spoil over the front of the trencher directly into trucks has been designed for the Parsons Model 250 Trenchliner. The new loading feature, combined with the conventional side discharge conveyor and the standard offset boom, adds to the number of job applications for the Model 250. The trencher is especially ideal for digging deeper and wider trenches while working on streets, alongside highways, in alleyways or other close quarter work areas. Mounted within the main frame of the trencher and extending out over the main power unit, the front end discharge conveyor allows over 10½ feet of clearance for loading into all sizes of trucks. Conveyor belt is cleated, 24 inches wide, and powered with an auxiliary engine. For more data write Parsons Co., Newton, Ia., or circle **No. 2-7** on the reply card.



**Trencher** has the front end discharge



**Pick-up** truck tows this generator set

### Expanded Line of Diesels Ranging from 20 to 1650 HP

With the addition of eight new "V" and "in-line" engines to its line of two-cycle Diesels, the Detroit Diesel Engine Division of General Motors greatly expands the usefulness of GM diesel power in the standby generator field. Combined with previously existing Series 71 and 110 units, the new engines complete a line consisting of 19 single and multiple units ranging from 20 to 1650 hp in only three cylinder sizes. The units are capable of driving generators producing up to 700 kw. In the lower power ranges, the engines are "in-line" units of 2, 3 and 4 cylinders and there is a highly compact 6-cylinder "V" engine of 195 maximum hp. In the higher horsepower ranges, the four "V-type" engines are of 6, 8, 12 and 16 cylinders ranging from 252 to 675 maximum hp. Complete data from Detroit Diesel Engine Div., General Motors Corp., 13400 W. Outer Drive, Detroit 28, Mich., or circle **No. 2-9** on the reply card.

### Clamp for Repair of Water and Sewage Lines

Efficient, fast, economical repair of breaks or holes in small-diameter asbestos-cement and cast iron water and sewage lines is now possible with Dresser's new 2 and 3-in. "360" all-around repair clamps. These new clamps differ in design from the larger size "360's" in that they have lugs on only one side. This feature simplifies installation. Procedure is: Remove the bolts from the lugs, spring the clamp around the pipe, re-insert the bolts and tighten the nuts. Dresser's "360" sliding lug design eliminates weak or loose parts and assures a positive, leakproof seal. Bolt pull is transmitted effectively into pressure, preventing pivoting action or bolt bending. The lugs also permit a range of adjustability sufficient to compensate for variations in asbestos-cement and cast iron pipe diameters. For more details write Dresser Mfg. Div., One of the Dresser Industries, Inc., Bradford, Pa., or circle **No. 2-10** on the reply card.

### Bros Self-Propelled Pneumatic Tire Roller

An improved medium weight self-propelled pneumatic tire roller has been introduced by Bros Incorporated. Designated the Bros SP-54B the ballast range can be varied to produce from 3 to 10 tons compaction load. New design and performance features include a lower center of gravity to increase machine stability for shoulder work and steep grades; full machine height to top of steering wheel is only 91 ins. Improved power hydraulic steering and velvet drive hydraulic reversing clutch and transmission provide a new ease of operation and handling for shuttle or back-and-forth rolling. For more information write Bros Inc., Minneapolis, Minn., or circle **No. 2-11** on the reply card.

**Roller** has power hydraulic steering

### Pipetting Device

A new pipetting device, the Pumpett automatic pipette control, makes it unnecessary to fill a laboratory pipette by mouth suction. The Pumpett is designed for operation with one hand, either right or left. The thumb presses a large rubber bulb at the top to provide suction, and the forefinger operates the coarse air control valve. For micro quantities, a small internal rubber bulb, depressed by a control knob screw, can be operated independently. All sizes of pipettes can be accommodated, even microcapillary, in the rubber-lined chuck jaws. These jaws are springloaded and operated by a lever to clamp or release a pipette. Pipettes need not be touched by hand at all. The Pumpett is especially recommended for safety where corrosive, toxic, or infectious liquids and sterile or radioactive solutions are handled. For more information write to Arthur S. LaPine and Co., 6001 South Knox Ave., Chicago 29, Ill., or circle **No. 2-12** on the reply card.

### Guard Rail for Building Protection and Traffic Use

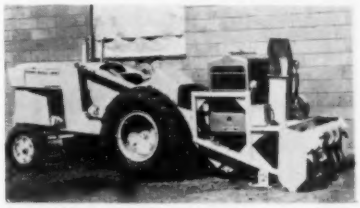
Hi-Guard steel guard rail to protect buildings, loading ramps and docks and in defining traffic lanes and parking lots is available from A. J. Bayer Co. It comes in standard lengths, either single or double rib, and also in special lengths with special hole punching, finish and forming to special radii when specified. Spring type or flush mount brackets are standard equipment. End pieces are designed with no sharp or protruding areas and rail sections can be mounted on either concrete, steel or wood anchor posts. More data from A. J. Bayer Co., 2300 E. Slauson Ave., Los Angeles 58, Calif., or circle **No. 2-13.**

### Freeman Loader for Ford and Ferguson Tractors

Introduction of an all-new, heavy duty type loader for Ford and Ferguson tractors, is announced by Freeman Loader. Known as Model M-601, the new loader has capacity to lift 1200 lbs. to a height of 8½ feet (to bottom of bucket). Ease of attaching to tractor and removing are features; no removal of tractor lights is necessary. The 9-cu. ft. bucket (combined with gravel plate) is 40 ins. wide and has bolted-in 1⅛-in. axle steel teeth. For complete details write Freeman Loader Corp., Peru, Ind., or circle **No. 2-14** on the reply card.

### New 14,000-lb. per Min. Rotary Snow Plow

A 14,000-pound-per-minute model of the Ram two-auger snow plow has been introduced by Ram Equipment Co. The all-steel welded snow plow has the advantage of being attachable to front-end loaders. Designed primarily for clearing roads and loading snow into trucks, it also has a wide field of application such as cleaning airports and maintenance yards. The plow is powered by a four-cylinder Hercules GO-226 gasoline engine, which develops 87.5 hp at 3200 rpm and maximum torque of 182 ft. lbs. at 1400 rpm. For further information write Ram Equipment Co., Minneapolis, Minn., or circle **No. 2-15** on the reply card.



**Two-auger** rotary snow plow is equipped with a Hercules gasoline engine

### Pavement Test Core Drill

Acker Drill Co. has available a new high speed pavement test core drill. It is all-hydraulic, trailer-mounted, and has an integral water

pump and water tank. The unit is ideal for developing 2 to 8-in. diameter cores from asphaltic pavements or concrete runways using Thin Wall diamond bits for coring. Write for full details to Acker Drill Co., Inc., Box 830, Scranton, Pa., or circle **No. 2-16** on the reply card.

## Barber-Greene Adds Two New Wheel Ditchers

Two new wheel ditchers, the Models 772 and 773 have been added to the Barber-Greene line. The B-G ditcher group now includes several models of all three ditcher types: wheel; ladder; and vertical boom. The Model 772 has a maximum digging depth of 5½ ft. with a range of digging widths from 14 to 24 ins. The Model 773, which is identical in mechanical details, differs in that it offers a wider crawler tread and either 14-in. or 16-in. wide crawler pads, instead of the 10-in. wide pads on the Model 772. For more details write Barber-Greene Co., 400 No. Highland Ave., Aurora, Ill., or circle **No. 2-17** on the reply card.

**Wheel** ditchers have digging depth of 5½ ft. and digging widths of 14 to 24 inches

**Greater** accuracy of the detector will reduce the possibility of cutting pipe

### Detectron Pipe Detector Redesigned

The newly designed circuit and internal construction of the Detectron pipe detector, made by Computer - Measurements Corp., has greatly improved its efficiency. A signal of much sharper cut-off more accurately determines the exact number of pipes which may lie in the path of the bulldozer or ditching machine. The increased sensitivity of the exclusive "505" circuit is of great importance since fewer deep pipes will be missed which might later be cut by a ditcher. For full details write Computer - Measurements Corp., Dept. 55-A, 5528 Vineland Ave., North Hollywood, Calif., or circle **No. 2-18** on the reply card.

## Self-Propelled Trenching Machine

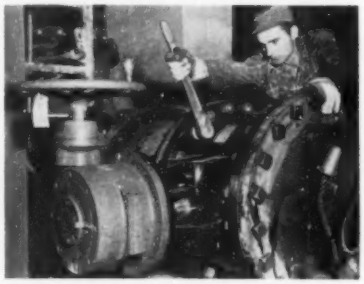
The Trench-Devil Model M-A, is a self - contained, self - propelled trenching machine available from Arps Corp. The unit has a reversible conveyor that can be changed in less than a minute to deposit dirt to the left or right side. Also featured are a power driven hydraulic boom lift, with up and down pressure and a two piece main drive shaft that permits quick and easy change of drive sprocket. For full details write Arps Corp., New Holstein, Wisconsin, or circle **No. 2-19** on the reply card.

**Trenching** machine can be used for water services, sprinkler systems and foundation digging in municipal work

### Parking Lot Marking Paint

A tough new traffic paint that provides brilliant, long-lasting traffic markings on asphalt, macadam, concrete, cobblestone and tarred road surfaces has been introduced by the Consolidated Chemical and Paint Mfg. Co. Tests reveal the new enamel provides markings comparable in brilliance to beaded traffic paints and affords great resistance to wear and abrasion. Because it dries in minutes, truck and auto tires leave no imprint on Jet-Dri surfaces. The paint may be applied rapidly by conventional highway painting equipment or by hand with brush or roller. Additional information from Jet-Dri Div., Consolidated Chemical and Paint Mfg. Co., Inc., 444 Lafayette St., N. Y., N. Y., or circle **No. 2-20** on the reply card.

### Full Size Range of 125-lb. Butterfly Valves



**Valve** with manual operator being installed in municipal pumping station

B-I-F Industries announces the expansion of its line of tight-closing butterfly valves to include 125-pound butterfly valves. The expanded line of high pressure valves is ideal for use as replacement valves, for pressure reducing and throttling functions, for street shutoff, pump discharge, altitude storage control, distribution systems, etc. Sizes range from 4 to 48 ins. They are light in weight and compact and can be supported by the line, eliminating special construction. For further information write B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I., or circle **No. 2-21** on the reply card.

### Heavy-Duty Self-Priming Pump

A new, lightweight, heavy-duty self-priming pump has been added to the Hale line of Torrent pumps. Powered by a 9 hp Briggs and Stratton engine standard-equipped with exhaust valve rotator, the new pump is said to be capable of pumping 22,000 gph, yet weighs only 145 pounds. It is designed for pumping water from excavations, cellars, manholes and for general utility pumping where it is desirable to move large volumes of water at low cost. Impeller wear adjustment is simple and can be accomplished externally without dismantling the pump. Design eliminates all paper gaskets. For more information write to Hale Fire Pump Co., Conshohocken, Pa., or circle **No. 2-22.**

### Rogers Industrial Locomotives

Rogers Brothers Corp. has announced the availability of diesel-hydraulic and diesel-electric locomotives in 5 to 40-ton sizes and track gauges from 21 to 56½ ins. Each locomotive embodies a powerful high torque diesel engine, an efficient torque converter and a power shift transmission which makes manual shifting unnecessary. Available is a complete line of related accessories including a patented, newly designed fume scrubber to adapt the locomotives for use in buildings, tunnels and other confined areas. For more details write Rogers Brothers Corp., Albion, Penna., or circle **No. 2-23.**

### Concrete Curing Blankets

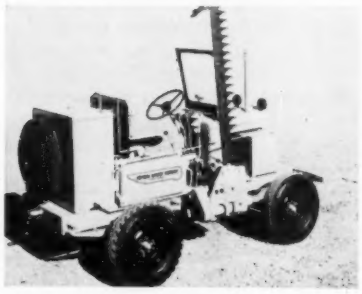
A new product designed to protect freshly poured concrete while curing has been announced by Owens-Corning. Known as Fiberglas concrete curing blanket, the product protects curing concrete from inclement weather and freezing temperatures. It is a fine-fibered, flexible, resilient, felt-like blanket of fibrous glass bonded with a thermo-setting resin, completely enclosed in a tough 8-mil black polyethylene film. It allows relatively little water loss and temperature variations during the curing period and is specifically designed for repeated use after rough service. It can be moved from pour to pour quickly and with little effort and there's nothing to clean up after it has been moved. Any rips or tears which might occur can be easily repaired. For more data write Owens-Corning Fiberglas Corp., Toledo 1, Ohio, or circle **No. 2-24.**

**Freshly** poured concrete is protected

### New High Capacity Diesel Electric Plants

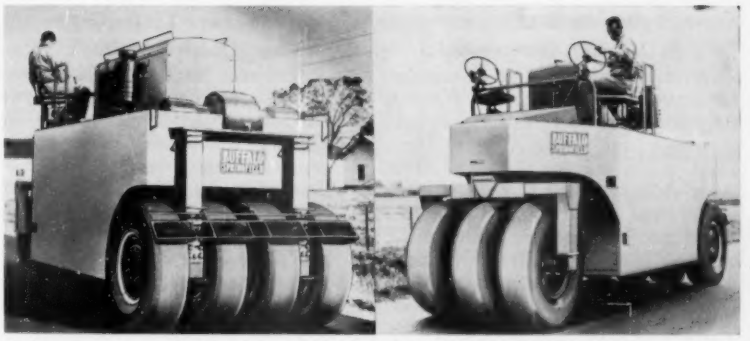
These new Onan diesel generating sets have been developed especially to meet the demands for auxiliary diesel emergency electric power wherever standby electric power insurance is desired and needed. Where the new Onan Diesel units are rated for continuous duty (50kw, 75, 125, 150, 175, 200kw), they will prove useful as primary power units on construction sites or similar applications. Each plant in these new series is a complete, self-contained electric generating set, with the diesel engine, alternator, exciter and control panel assembled into one compact unit. For more data write D. W. Onan & Sons Inc., Minneapolis 14, Minn., or circle **No. 2-25** on the reply card.

### Roadside Mower



**Mower** can be removed in ten minutes

A newly designed roadside mower with hydraulic actuation has been announced by Topeka Hiway Mower. The new Topeka Forty Mile mower is not a tractor attachment, but a completely integrated machine designed and engineered for fast and economical mowing. Of special interest is the fast on-and-off chemical power sprayer attachment. It sprays weed-killing chemicals along the fence line at the same time it mows. The heavy channel frame construction permits the use of a front end loader for stock pile work. One man can attach or remove the hydraulic mowing mechanism in ten minutes. Road travel speeds of 40 to 45 mph give more actual mowing time each day and lengthen the life of the machine by having it under cover during bad weather, and available for servicing. Mowing speeds are from 1 to 10 miles per hour. The sickle cuts downward at an 80° angle, and upward at a 90° angle, for mowing over rough terrain. For complete information write Topeka Hiway Mower, Inc., Topeka, Kansas, or circle **No. 2-26** on the reply card.



**Roller** has four-wheel drive, dual controls, power steering and full visibility

## 7-Wheel Pneumatic Tire Roller Has 4-Wheel Drive

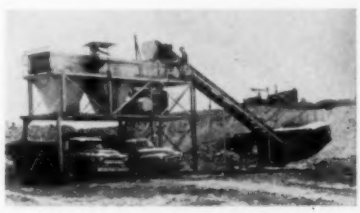
Compaction of sub-base, base, and finish (asphaltic concrete) courses of flexible type pavements are a few of the job applications of Buffalo - Springfield's self - propelled pneumatic tire roller. Also the 10-30 ton, 7-wheel unit, designated the model PSR-30, can be used for compaction of embankments for highways, airport runways, dams and building sites. A special transmission, including torque converter, offers three speed ratios and an infinite range of rolling speeds up to 19 mph forward and reverse. Speed shifting and reversing clutches are hydraulic actuated. Power is obtained from a 125 hp Cummins diesel engine. Complete dual operating controls include automotive type, hydraulic powered steering. Right and left hand operator seats are adjustable, can swivel 360° and can be locked at 90° increments. Both steering and drive wheels are visible to the operator from either operator position. By varying the type and amount of ballast, wheel loads from 3340 lbs. per wheel to 8600 lbs. per wheel can be obtained. All wheels oscillate, the drive wheels in pairs and steering wheels through a center-pivoted yoke, to give maximum compaction, regardless of grade contour. For more details write Buffalo-Springfield Roller Co., Div. of Koehring Co., 1210 Kenton St., Springfield, Ohio, or circle **No. 2-28** on the reply card today.

### Plastic Trafficones

A complete line of trafficones, adapters and accessories made of Poly Vinyl Chloride (plastic) has been developed by Interstate Rubber Products. These new plastic cones are available in three standard sizes—12, 18 and 28 ins. Heavily constructed and properly engineered to resist greater wind velocities they are tough, flexible plastic that will withstand rough wear and abuse. Pigment is impregnated throughout the compound producing brilliant red and yellow colors for better visibility. The fast colors will remain bright and effective for years. No painting or maintenance is required. For more details write Interstate Rubber Products Corp., 908 Avila St., Los Angeles 12, Calif., or circle **No. 2-27** on the reply card.

### Central-Mix Stabilization Plant

A 1,000 ton-per-hour central-mix stabilization plant is announced by The Boardman Co. Completely portable, it is equipped with double discharge hoppers and it may be obtained with or without air brakes. Of the pug-mill type, the plant is engineered and built for construction jobs in which large tonnage is required. The basic unit includes a twin shaft pug-mill type mixer and a 5-cu. yd. discharge hopper with a hydraulically operated clamshell gate. It also is built with an operator's platform running the full length of the unit. It includes a self-priming water pump and precision water meter to assure an accurate water flow to the spray bar. The basic unit is for the preparation of stabilized aggregate base material, but it can be converted to a soil-cement stabilization plant. For more details write The Boardman Co., 1401 S. W. 11th St., Oklahoma City, Oklahoma, or circle **No. 2-29** on the reply card.



**Plant** can produce 1,000 tons per hour

### Polyester Dial Plate Is Durable, Economical

A water meter dial plate, molded of glass fiber reinforced Plaskon Polyester 941, that resists rust and corrosion and eliminates replacement problems is available from Hays Mfg. Co. The easy-to-read plastic dial features printing laminated into its surface. Characteristic of the Plaskon Polyester Resin used is the ease with which it may be formed and its excellent resistance to heat and common solvents. It is made in sheets and then cold-punched. For more information write the Hays Mfg. Co., 801 West 12th St., Erie, Pa., or circle **No. 2-30** on the reply card.

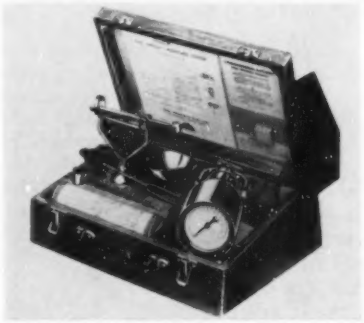
## Paving Breaker

A new medium weight paving breaker is announced by Davey Compressor. Known as Davey-Holman Model SS-32, it is said to have an extremely high power-to-weight ratio and to be suitable for all but the heaviest demolition jobs. An outstanding feature is the complete housing by the cylinder of the entire valve mechanism. It has a net weight of 60 lbs. and is 22½ inches long. Bore is 2 inches, stroke 5 inches. The tool delivers 1,250 blows per minute. For complete information write Davey Compressor Co., Kent, Ohio, or circle **No. 2-31** on the reply card.

**Davey-Holman** SS-32 paving breaker is 22½ inches long, delivers 1,250 blows per minute and weighs 60 pounds net

### Moisture Tester Gives Quick Results

Invaluable for field work as well as in laboratories, the Speedy moisture tester available from The Alpha-Lux Co., is self-contained and portable and can be used with accuracy by any unskilled operator. A reading can be obtained on most materials within three minutes. The principle of operation is instant release of gas from Speedy absorbent on contact with the mositure in the sample. The pressure of gas released registers on the dial gauge, indicating the percentage of water. The



**Testing** instrument is used in highway and reservoir earthwork building

complete outfit—comprising the actual testing instrument, a counterpoised balance (no weights needed), scoop for measuring Speedy absorbent, a tin of absorbent, sufficient for 50 tests, a cleaning brush, a spare rubber washer and complete working instructions—is supplied in a carrying case and weighs 12 lbs. More details from The Alpha-Lux Co., 155 John St., New York 38, N. Y., or circle **No. 2-32** on the card.

• • •

### Savings in Highway Costs by New Methods

A method developed at MIT by Prof. Charles L. Miller, called the Digital Terrain Model System, is one of the techniques that is now being used on an experimental basis in highway work in several states. Devised in the Photogrammetry Laboratory of MIT, this is a system by which the terrain can be surveyed by means of 3-D aerial photographs.

The photographs are projected in red and blue light on a machine controlled by an operator who wears spectacles with a red lens and a blue lens to achieve a stereoscopic effect. The machine measures hills and valleys and automatically records the measurements for subsequent input to a computer, which stores the data in an electronic memory device.

### Public Health Service Regular Corps Examinations Announced

A competitive examination, for appointment of Sanitary Engineer Officers to the Regular Corps of the United States Public Health Service, will be held in various places throughout the country on April 21 through 24, 1959. Appointments will be made in the ranks of Assistant and Senior Assistant grades, equivalent to Navy ranks of Lieutenant (j. g.) and Lieutenant, respectively. Entrance pay for an Assistant Sanitary Engineer with dependents is $4,817; for a Senior Assistant Sanitary Engineer with dependents, $6,270. Benefits include periodic pay increases, 30 days annual leave, sick leave, medical care, disability retirement pay, regular retirement pay and other privileges. Active duty as a Public Health Service officer fulfills the obligations of Selective Service.

Requirements for both ranks are United States citizenship and graduation from a recognized engineering college or university. Applicants for the Assistant Sanitary Engineer Officer rank must have at least three years of professional training and experience (bringing total training and experience to a minimum of seven years). For the Senior Assistant Sanitary Engineer rank, an applicant must meet these requirements plus three additional years of professional training and experience (bringing total to no less than ten years). The entrance examination will include an oral interview, physical examination, and comprehensive objective examinations in the professional field. Application forms may be obtained by writing to the Surgeon General, United States Public Health Service (P), Washington 25, D. C. Completed application forms must be received in the Division of Personnel no later than March 6, 1959.

### Water for Yankee Atomic Electric Plant

A nuclear power station at Rowe, Mass., being built as a joint venture of leading New England Power Companies, will have a capacity of about 135,000 kilowatts. To be known as the Yankee Atomic Electric Plant, it will probably be the largest nuclear power station built to date. Hungerford & Terry Inc., engineers and manufacturers of water conditioning plants of Clayton, New Jersey, are contractors under Stone & Webster Engineering Corporation of Boston, Massachusetts for the water treating equipment.

## FILMS & TRAINING IN REFUSE COLLECTION

In the January issue of PUBLIC WORKS magazine on page 150 is a reference to a film "Collector's Item" which apparently covers refuse collection.

Perhaps you can supply me with more information regarding this film such as: Its coverage, availability and whether it would be suitable as a training film for drivers and lifters and Incinerator plant personnel.

At your earliest convenience if you would forward this information it would be greatly appreciated.

*Harold F. Steidel*
Jersey City Incinerator Authority
Box 97, 5 Corners Sta.
Jersey City 8, N. J.

I would like to know of any films available for municipal workers engaged in public works activities, specifically garbage collection and public relations if obtainable.

Also, is there any catalog of such films?

*Henry Dunn, Jr.*
City Manager
Mount Holly, N. C.

## TRAINING PROGRAM FOR CITY INSPECTORS

The City of Highland Park has recently undertaken a new training program which, I believe, will reap great benefits for ourselves and others participating in the program. A brief discussion of the training program will be of interest.

In preparing the 1958-59 budget, P. E. Cole, City Engineer, requested that funds be authorized for conducting an Engineering Inspectors' Conference during the late fall and winter months. Funds for this in-service training program were provided and Mr. Cole initiated arrangements for the conference. Neighboring communities were contacted as to their interest, and participation was assured by the villages of Glencoe and Deerfield and the City of Lake Forest. Engineering consultants in the general area also indicated an interest, and some of their personnel are participating in the program. Various manufacturers' associations were then asked to provide instruction in the best methods of installation of their products. The conference consists of fifteen weekly sessions conducted on the employee's time.

The first two-hour session was held on Wednesday, November 5, 1958. It was part of a six-week series devoted to a discussion of quality concrete, pavement construction, use of concrete pipe and the role of prestressed concrete. This series was conducted by the Portland Cement Association and included actual design and mixing of test mixtures of concrete as well as lectures. Following this, the Clay Products Association and the American Vitrified Products Association will conduct a two-meeting series on the use of vitrified clay pipe. The next five sessions will be devoted to the study of asphalt products. The Asphalt Institute will provide instruction on asphalt as a material, surface treatments, hot-mix construction and maintenance of pavement surface. The final two sensions of the conference will consist of instruction by the Cast Iron Pipe Research Association on the use and installation of cast iron pipe. Certificates will be issued by the City to those participants completing the various phases of the conference.

There will be two direct benefits as a result of this training program, the one to the employees, the other to the City. The additional training will make the employees more competent in fulfilling their duties and will, therefore, improve their opportunities for promotion and salary increases. The City in turn will have available among its own employees personnel who are trained to function as inspectors on various public improvement projects.

*Frank U. Koehler*
Administrative Assistant
Highland Park, Ill.

## Illinois Highway and Traffic Conferences

The 45th Annual Illinois Highway Engineering Conference will be held at the University of Illinois, Urbana, Ill., on February 24, 25 and 26, 1959.

The 11th Annual Illinois Traffic Engineering Conference will be held at the University of Illinois on February 26 and 27, 1959.


# CLASSIFIED ADVERTISING

**Position Available**
**WATER SYSTEM MANAGER**

A County owned and operated water filtration plant and system in Georgia invites applications from men 30 to 50 years of age with at least 5 years responsible managerial experience in public or private water systems. Salary open depending on qualifications. Modern plant and system currently in operation. Interested applicants should send complete resume of experience, personal data and salary desired to:

**Box 2-1**
*Care of Public Works Magazine*

**CIVIL ENGINEER WANTED**

Registered professional engineer with experience in municipal street and sewer design. Beginning annual salary approximately $7075.00 with increase at the end of the first six months. Annual 5% increase each year for the next three years to a final annual salary after three and one half years of approximately $8410.00. Normal fringe benefits. Submit resume and references to:

**Director of Public Service**
**City of Middletown**
**P. O. Box 530**
**Middletown, Ohio**

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**SANITARY ENGINEERS WANTED**

Leading Midwestern manufacturer of Sewage and Industrial Waste Treatment Equipment and Building Pumps needs Graduate Sanitary Engineers to train for either inside or field positions. No experience required. Excellent opportunity for permanent position with well established growing concern. Resume required.

*Write to:*
**Box 2-2C**
*Care of Public Works Magazine*

**CITY ENGINEER WANTED**

Minimum age 35-40, to head the department in a town of over 80,000. Must have considerable background experience. Contact:

**Mr. Ivan Bray**
**Director of Personnel**
**Sioux City, Iowa**

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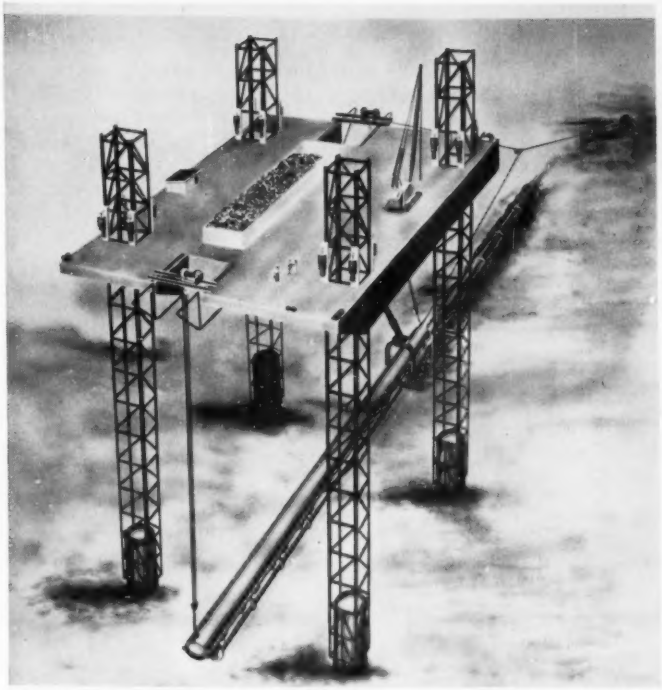
# —Worth Seeing



**Six-mile long outfall** of Los Angeles Hyperion Treatment Plant will be placed in water up to 200 feet deep by this mobile offshore platform. Rig will lower 600-ton assembled sections of 12-foot dia. pipe to the ocean floor, connect it with previously laid sections and backfill with gravel cradle. Alinement, jointing and backfilling will be monitored by closed circuit underwater TV unit. Hyperion Constructors, a joint venture of six firms, is handling the $20 million sewer pipe project.

**"World's** most brilliantly lighted street," State Street in Chicago, on a rainy evening. This picture was made on an 8 x 11 mm negative (ASA 200) with a Minox ultra-miniature camera, f3.5 at 1/25, by Don Gehring, Wire Reinforcement Institute. Box at corner shows the original size.

**Special care** was needed during repavement of the MacArthur Bridge, St. Louis, to prevent vibration from traffic on operating lanes from disturbing bond between tie rods and new concrete. Engineers of LaClede Steel Company helped solve the problem by using asphaltic wrappings as cushions.

**Eight** new International 340 utility tractors equipped with three-gang, high-speed Mott hammer knife mowers have started work on Illinois Tollway grass areas. Machines cover a strip 13 feet wide and can mow and shred grass on nearly 150 acres of shoulder per day.

**New Dorr-Oliver headquarters** building in Stamford, Conn., provides 120,000 sq. ft. of office space in pleasant surroundings.

The Heart of fine WATER PURIFICATION

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Roberts Mechanical Equipment

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SEND FOR FREE 1959 CATALOG
FISHER Research Lab., Inc.
Dept. PW-3, Palo Alto, Calif.

by Arthur K. Akers

★ DAN R. GANNON now holds the title of vice president and general sales manager, Mueller Co., Decatur, Ill.

★ THOMAS T. QUIGLEY moves upward again: this time to vice-president, Equipment Divisions of Wallace and Tiernan Inc. Tom's friends, who are legion, will welcome this news.

Mr. Quigley

Mr. Floyd

★ ROSS J. BURNS is appointed general sales manager, municipal and industrial divisions, Badger Meter Co., Milwaukee. Charles J. Floyd, Jr., succeeds him as national water meter sales manager.

★ EVERETT M. JONES has resigned as vice president and general manager, Simplex Valve and Meter Co., subsidiary of Pfaudler Permutit Inc. We join the host who will miss "Casey" Jones. J. M. Hultz succeeds him as general manager.

★ PHILIP R. HIRSH moves up to chairman of the board, Lock Joint Pipe Co. C. Mack Albertson, former district sales manager at Turner, Kansas, becomes manager of pressure pipe sales.

★ ROOTS CONNERSVILLE BLOWER Division of Dresser Industries announces these executive changes: Glenn H. Crocker, to general sales manager; H. W. Newsome to manager of the new district sales office, Los Angeles 58, Calif.; Paul E. Johnson to manage the new Atlanta 5 office; Philip J. Bettendorf is new district sales manager, Detroit office, replacing Daniel R. Fulton who will open the new Houston office.

★ DORR-OLIVER Inc. has moved all filtration engineering and development operations from Oakland, Calif., to their new international headquarters at Stamford, Conn.

★ JOHN E. CLARK is now director of promotion for the Structural Clay Products Institute.

★ DAVID J. DAVIS is named director of sales and advertising, Gar Wood Industries, Wayne, Mich.

★ HERSEY MFG. CO., Dedham, Mass., expands its Water Meter sales force with A. Richard Moore, at Melrose, Mass., and V. Randolph Chowning, Jr., at Richmond, Va.

★ RECORDAK CORPORATION elects Van B. Phillips vice-president of sales and advertising.

Mr. Phillips

Mr. Chriswell

★ LLOYD A. RAGER is advanced from advertising manager LeTourneau-Westinghouse Co. to manager of the new Motor Grader Sales Department. Kenneth W. Chriswell succeeds as advertising manager.

★ WITH REGRET we publish news of the death of Edward H. Canon, founder and former general manager, Standard Dry Wall Products Inc. Schuyler C. Begg succeeds him as general manager and treasurer. Phil C. Donnelly becomes general sales manager, with Robert C. Saunders his assistant and director of advertising.

★ CURRENT COLD WAVES remind us of the cartooned Tremblechin bracing his boss for a raise. "Ordinarily, sir," he quavers, "I can stay alive on my salary but for the past two weeks the ground has been frozen and I can't dig for roots."

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